

SEQUENCE LISTING

5 <110> Alex Bollen
 Alain Fauconnier
 Edmond Godfroid
 <120> Vaccine
 10 <130> B45168
 <160> 82
 15 <170> FastSEQ for Windows Version 3.0
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 <212> DNA
 20 <213> Bordetella pertussis
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 Met Thr Ser Lys Lys Ser Ile Arg Arg Leu Gln Arg Ala Val Ala Leu
 1 5 10 15
 30 gcc acc agc cgc aac gac atc gta ctg gcc gtg ctc atc gtg gcg atc 96
 Ala Thr Ser Arg Asn Asp Ile Val Leu Ala Val Leu Ile Val Ala Ile
 20 25 30
 35 gtc ttc atg atg atc ctg ccg ttg ccc aca acg ctg gtc gac gtg ctg 144
 Val Phe Met Met Ile Leu Pro Leu Pro Thr Thr Leu Val Asp Val Leu
 35 40 45
 40 atc ggt gcg aac atg acg ctg tcg gca gtc ctg ctg atg gtc gcg atg 192
 Ile Gly Ala Asn Met Thr Leu Ser Ala Val Leu Leu Met Val Ala Met
 50 55 60
 45 tac ctg cct tcg ccc ctg gcg ttt tcc tcg ttc cct tcg gtc ctg ctg 240
 Tyr Leu Pro Ser Pro Leu Ala Phe Ser Ser Phe Pro Ser Val Leu Leu
 65 70 75 80
 50 gtc acc acg ctg ttc cgg ctg ggc atc tcc atc gcg acc acg cgg ctg 288
 Val Thr Thr Leu Phe Arg Leu Gly Ile Ser Ile Ala Thr Thr Arg Leu
 85 90 95
 55 atc ctg ctg caa ggc gat gcc ggc cac atc atc gag acc ttc ggc aac 336
 Ile Leu Leu Gln Gly Asp Ala Gly His Ile Ile Glu Thr Phe Gly Asn
 100 105 110
 60 ttc gtg gtg ggc ggc aac ctg atc gtc ggc ctg gtg gtt ttc ctc atc 384
 Phe Val Val Gly Gly Asn Leu Ile Val Gly Leu Val Val Phe Leu Ile
 115 120 125
 ctc acg atc gtg cag ttc gtg gtc atc acc aaa ggc gcg gag cgg gtg 432
 Leu Thr Ile Val Gln Phe Val Val Ile Thr Lys Gly Ala Glu Arg Val
 130 135 140

2

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5	ctc acc gac gat ctg ctg cag atc cgg cgg gcg ctc tat ttc gac ctg Leu Thr Asp Asp Leu Leu Gln Ile Arg Arg Ala Leu Tyr Phe Asp Leu 385 390 395 400	1200
10	ggc gtg ccg ttt ccc ggc atc cag ttg cgc ttc acc gaa gcg ctg gcc Gly Val Pro Phe Pro Gly Ile Gln Leu Arg Phe Thr Glu Ala Leu Ala 405 410 415	1248
15	gcc aat acc tac acc atc gtg ctg tcg gag atc ccg gtg gcg caa gga Ala Asn Thr Tyr Thr Ile Val Leu Ser Glu Ile Pro Val Ala Gln Gly 420 425 430	1296
20	atg ttg cgc gac gat gcc gtg ctg gtg cgg gac acc gag cag aac ctg Met Leu Arg Asp Asp Ala Val Leu Val Arg Asp Thr Glu Gln Asn Leu 435 440 445	1344
25	cag gcc ctg cgg atc gca tac gaa acg ggc gcg gcc ttt ctg ccc gat Gln Ala Leu Arg Ile Ala Tyr Glu Thr Gly Ala Ala Phe Leu Pro Asp 450 455 460	1392
30	acg ccc acg atc tgg gtt gcg gcc agt ctg acc ggc gcc ttg cgc gat Thr Pro Thr Ile Trp Val Ala Ala Ser Leu Thr Gly Ala Leu Arg Asp 465 470 475 480	1440
35	gca ggt att cct tac ctg ggt atc agc cag atc ctg act tgg cac ttg Ala Gly Ile Pro Tyr Leu Gly Ile Ser Gln Ile Leu Thr Trp His Leu 485 490 495	1488
40	gca tat gta ttg aaa aaa tat tca gcc gat ttc atc ggc atc cag gaa Ala Tyr Val Leu Lys Lys Tyr Ser Ala Asp Phe Ile Gly Ile Gln Glu 500 505 510	1536
45	acc cgg ttt ctg ctt tcg gcc atg gaa gaa cga ttt ccc gat ctg gtc Thr Arg Phe Leu Leu Ser Ala Met Glu Glu Arg Phe Pro Asp Leu Val 515 520 525	1584
50	aag gag tgc ctg cgc gtc atg ccg gtg cag aag att gcc gaa atc ctg Lys Glu Cys Leu Arg Val Met Pro Val Gln Lys Ile Ala Glu Ile Leu 530 535 540	1632
55	cag cgc ctt gtt tcc gaa gaa gtg tcg ata cgc aac ctg cgc gcc gtc Gln Arg Leu Val Ser Glu Glu Val Ser Ile Arg Asn Leu Arg Ala Val 545 550 555 560	1680
60	ctg gaa gcg ctg gtc gaa tgg ggc cag aag gaa aag gat acc gtc ctg Leu Glu Ala Leu Val Glu Trp Gly Gln Lys Glu Lys Asp Thr Val Leu 565 570 575	1728
65	ctt acg gag tat gtc cga atc gca ctc aag cgc tat atc agc cac aag Leu Thr Glu Tyr Val Arg Ile Ala Leu Lys Arg Tyr Ile Ser His Lys 580 585 590	1776
70	tac acc agc ggc cac aat atc ctg ccc gcc tac ctg ctg gcc ccc aag Tyr Thr Ser Gly His Asn Ile Leu Pro Ala Tyr Leu Leu Ala Pro Lys 595 600 605	1824
75	gtc gag gaa acc gtg cgc gcc gcc atc cgg cag acc gcc gcc ggc agt Val Glu Glu Thr Val Arg Ala Ala Ile Arg Gln Thr Ala Ala Gly Ser 610 615 620	1872

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5 tat ctc gcc ctc gat ccg gac acg aca cgc cga ctg gtc gag cac atc 1920
 Tyr Leu Ala Leu Asp Pro Asp Thr Thr Arg Arg Leu Val Glu His Ile
 625 630 635 640

10 cgt caa tgt gtc ggc gat ctg gcc gcc ggc gcg agc cgt ccc gtc ttg 1968
 Arg Gln Cys Val Gly Asp Leu Ala Ala Gly Ala Ser Arg Pro Val Leu
 645 650 655

15 ctg acg tcg atg gac atc cgg cgc tac acg cgc aag atg ata gaa gcc 2016
 Leu Thr Ser Met Asp Ile Arg Arg Tyr Thr Arg Lys Met Ile Glu Ala
 660 665 670

20 gat ctc tac gcc ctg ccg gtg ctg tcc tac cag gaa ctg acg ccg gag 2064
 Asp Leu Tyr Ala Leu Pro Val Leu Ser Tyr Gln Glu Leu Thr Pro Glu
 675 680 685

25 atc aat gta cag ccc ctg ggc agg gtg gat cta tga 2100
 Ile Asn Val Gln Pro Leu Gly Arg Val Asp Leu *
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30 <210> 2
 <211> 699
 <212> PRT
 <213> Bordetella pertussis

35 <400> 2
 Met Thr Ser Lys Lys Ser Ile Arg Arg Leu Gln Arg Ala Val Ala Leu
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 Ala Thr Ser Arg Asn Asp Ile Val Leu Ala Val Leu Ile Val Ala Ile
 20 25 30
 Val Phe Met Met Ile Leu Pro Leu Pro Thr Thr Leu Val Asp Val Leu
 35 40 45
 35 Ile Gly Ala Asn Met Thr Leu Ser Ala Val Leu Leu Met Val Ala Met
 50 55 60
 Tyr Leu Pro Ser Pro Leu Ala Phe Ser Ser Phe Pro Ser Val Leu Leu
 65 70 75 80
 40 Val Thr Thr Leu Phe Arg Leu Gly Ile Ser Ile Ala Thr Thr Arg Leu
 85 90 95
 Ile Leu Leu Gln Gly Asp Ala Gly His Ile Ile Glu Thr Phe Gly Asn
 100 105 110
 Phe Val Val Gly Gly Asn Leu Ile Val Gly Leu Val Val Phe Leu Ile
 115 120 125
 45 Leu Thr Ile Val Gln Phe Val Val Ile Thr Lys Gly Ala Glu Arg Val
 130 135 140
 Ala Glu Val Ala Ala Arg Phe Ser Leu Asp Ala Met Pro Gly Lys Gln
 145 150 155 160
 50 Met Ser Ile Asp Ala Asp Leu Arg Ala Gly Thr Ile Asp Met Asp Glu
 165 170 175
 Ala Arg Arg Arg Arg Thr Val Glu Lys Glu Ser Gln Leu Tyr Gly
 180 185 190
 Ala Met Asp Gly Ala Met Lys Phe Val Lys Gly Asp Ala Ile Ala Gly
 195 200 205
 55 Leu Ile Ile Val Ala Val Asn Leu Leu Gly Gly Met Leu Val Gly Val
 210 215 220
 Leu Gln Arg Gly Leu Ser Ala Gly Glu Ala Val Gln Thr Tyr Ala Ile
 225 230 235 240
 60 Leu Thr Ile Gly Asp Gly Leu Ile Ala Gln Ile Pro Ala Leu Phe Ile
 245 250 255

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<213> Bordetella pertussis

<220>

<221> CDS

<222> (1)...(486)

5

<400> 3

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	Met Pro Lys Ser Ala Asp Gln Gly Gly Ser Pro Ala Ser Ala Ser His	
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15	gag gcg ttg cgc cat att ctc gac gca ggc gct tcg atg ggg ggc ttg	96
	Glu Ala Leu Arg His Ile Leu Asp Ala Gly Ala Ser Met Gly Gly Leu	
	20 25 30	
20	cag ggg ttg gac gag gcg cag cag cag gcg ttg tac gcg atc ggt cat	144
	Gln Gly Leu Asp Glu Ala Gln Gln Ala Leu Tyr Ala Ile Gly His	
	35 40 45	
25	ggc gcc tac gaa cag ggg cgc tat gcc gac gcg ttg aaa atg ttc tgc	192
	Gly Ala Tyr Glu Gln Gly Arg Tyr Ala Asp Ala Leu Lys Met Phe Cys	
	50 55 60	
30	ctg ctg gtc gcg tgc gat ccg ctg gaa gcc cgt tat ctg ctg gcc ctg	240
	Leu Leu Val Ala Cys Asp Pro Leu Glu Ala Arg Tyr Leu Leu Ala Leu	
	65 70 75 80	
35	ggc gcc gcg gcc cag gag ctg ggg ctg tac gag cat gcc ttg cag caa	288
	Gly Ala Ala Ala Gln Glu Leu Gly Leu Tyr Glu His Ala Leu Gln Gln	
	85 90 95	
40	tac gcg gcc gcg gcg gct ttg cag ttg gac tcc ccc agg ccc ctg ttg	336
	Tyr Ala Ala Ala Ala Ala Leu Gln Leu Asp Ser Pro Arg Pro Leu Leu	
	100 105 110	
45	cat ggc gcc gag tgc ctg tat gcg ttg ggt cgt cgc cgc gac gcc ctg	384
	His Gly Ala Glu Cys Leu Tyr Ala Leu Gly Arg Arg Arg Asp Ala Leu	
	115 120 125	
50	gat acg ctc gac atg gtg ctt gag ttg tgc ggc tcg ccg gag cgt gcg	432
	Asp Thr Leu Asp Met Val Leu Glu Leu Cys Gly Ser Pro Glu Arg Ala	
	130 135 140	
55	gcc ctg cgc gaa cgg gcc gag ttg ctg cgc agg agc tat gca cgt gcc	480
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60	gac tga	486
	Asp *	

<210> 4

<211> 161

<212> PRT

<213> Bordetella pertussis

<400> 4

Met Pro Lys Ser Ala Asp Gln Gly Gly Ser Pro Ala Ser Ala Ser His
1 5 10 15

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Glu Ala Leu Arg His Ile Leu Asp Ala Gly Ala Ser Met Gly Gly Leu
 20 25 30
 Gln Gly Leu Asp Glu Ala Gln Gln Gln Ala Leu Tyr Ala Ile Gly His
 35 40 45
 5 Gly Ala Tyr Glu Gln Gly Arg Tyr Ala Asp Ala Leu Lys Met Phe Cys
 50 55 60
 Leu Leu Val Ala Cys Asp Pro Leu Glu Ala Arg Tyr Leu Leu Ala Leu
 65 70 75 80
 10 Gly Ala Ala Ala Gln Glu Leu Gly Leu Tyr Glu His Ala Leu Gln Gln
 85 90 95
 Tyr Ala Ala Ala Ala Ala Leu Gln Leu Asp Ser Pro Arg Pro Leu Leu
 100 105 110
 His Gly Ala Glu Cys Leu Tyr Ala Leu Gly Arg Arg Arg Asp Ala Leu
 115 120 125
 15 Asp Thr Leu Asp Met Val Leu Glu Leu Cys Gly Ser Pro Glu Arg Ala
 130 135 140
 Ala Leu Arg Glu Arg Ala Glu Leu Leu Arg Arg Ser Tyr Ala Arg Ala
 145 150 155 160
 20 Asp

<210> 5
 <211> 1803
 <212> DNA
 25 <213> Bordetella pertussis
 <220>
 <221> CDS
 <222> (1)...(1803)
 30 <400> 5
 atg gca ata ggt cgg ctt ggg tat ctt gtc cgc ggc gca tgg gcc ggg 48
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 35 ggt gtc atg ctg ttg gcg gcc ggt agc gcc tgg gcg gcg ccg aac tgg 96
 Gly Val Met Leu Leu Ala Ala Gly Ser Ala Trp Ala Ala Pro Asn Trp
 20 25 30
 40 cct ttg gcg ccg tat agc tac tac gcg cag cag cag agc ctg tcc gat 144
 Pro Leu Ala Pro Tyr Ser Tyr Tyr Ala Gln Gln Gln Ser Leu Ser Asp
 35 40 45
 45 gtg ctg cgc gag ttc gcc gca ggc ttc agc ctg gcg ttg caa cag ggc 192
 Val Leu Arg Glu Phe Ala Ala Gly Phe Ser Leu Ala Leu Gln Gln Gly
 50 55 60
 50 aaa ggg gtg caa ggc gtg gtc aat ggg cgt ttc aat gcg cgc aca ccc 240
 Lys Gly Val Gln Gly Val Val Asn Gly Arg Phe Asn Ala Arg Thr Pro
 65 70 75 80
 acg gag ttc atc gag cgt ctc agc ggc atc tat ggg ttc aac tgg ttc 288
 Thr Glu Phe Ile Glu Arg Leu Ser Gly Ile Tyr Gly Phe Asn Trp Phe
 85 90 95
 55 gtg cat gcc ggc acg ctg tat gtc agc cgc acc agc gac gtg gtt acc 336
 Val His Ala Gly Thr Leu Tyr Val Ser Arg Thr Ser Asp Val Val Thr
 100 105 110
 60 cgc gcg gtg gat gca gcc ggc gct tcg ccg tcg gcg ttg cgc cag gcc 384

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	Arg	Ala	Val	Asp	Ala	Ala	Gly	Ala	Ser	Pro	Ser	Ala	Leu	Arg	Gln	Ala	
			115					120					125				
5	ttg	ctg	caa	ctg	ggc	atc	ctg	gac	gaa	cgc	ttc	gga	tgg	gga	gag	ctg	432
	Leu	Leu	Gln	Leu	Gly	Ile	Leu	Asp	Glu	Arg	Phe	Gly	Trp	Gly	Glu	Leu	
			130				135					140					
10	ccg	gcg	caa	ggc	gtg	gcc	atg	gtg	tca	ggg	ccg	ccg	gcc	tat	gtc	gcg	480
	Pro	Ala	Gln	Gly	Val	Ala	Met	Val	Ser	Gly	Pro	Pro	Ala	Tyr	Val	Ala	
						150					155					160	
15	ctg	gtc	gag	cag	ggc	gta	gcg	gcg	ttg	ccc	aag	ggg	gcc	ggc	aat	cag	528
	Leu	Val	Glu	Gln	Ala	Val	Ala	Ala	Leu	Pro	Lys	Gly	Ala	Gly	Asn	Gln	
					165					170					175		
20	cag	gtg	gcg	gtg	ttt	cgc	ctc	aag	cat	gct	tcc	gtg	agc	gac	cgg	gtg	576
	Gln	Val	Ala	Val	Phe	Arg	Leu	Lys	His	Ala	Ser	Val	Ser	Asp	Arg	Val	
				180					185					190			
25	atc	cgt	tat	cga	gac	cag	cag	gta	gtt	acg	ccg	ggg	atg	gcc	acc	atg	624
	Ile	Arg	Tyr	Arg	Asp	Gln	Gln	Val	Val	Thr	Pro	Gly	Met	ala	Thr	Met	
			195					200					205				
30	ctg	cgc	caa	ttg	atc	ctg	ggg	gcg	ggg	ccg	ggc	aac	gac	gcg	gcg	ctg	672
	Leu	Arg	Gln	Leu	Ile	Leu	Gly	Ala	Gly	Pro	Gly	Asn	Asp	Ala	Ala	Leu	
			210				215					220					
35	gcc	gcg	gtg	gcg	gcg	ccg	ctg	cgg	gaa	aat	ccg	ccg	gtg	ttc	ggc	gat	720
	Ala	Ala	Val	Ala	Ala	Pro	Leu	Arg	Glu	Asn	Pro	Pro	Val	Phe	Gly	Asp	
						230					235					240	
40	gcg	gca	gct	gac	ggg	aac	gcg	ccg	ctc	gct	ggc	gca	gcc	cag	gca	gcc	768
	Ala	Ala	Ala	Asp	Gly	Asn	Ala	Pro	Leu	Ala	Gly	Ala	Ala	Gln	Ala	Ala	
					245					250					255		
45	ggc	cgg	cgc	ctg	agc	gag	ccc	agc	gtg	cag	gcc	gac	acg	cgc	ctc	aat	816
	Gly	Arg	Arg	Leu	Ser	Glu	Pro	Ser	Val	Gln	Ala	Asp	Thr	Arg	Leu	Asn	
				260					265					270			
50	gcc	ttg	atc	gtg	cag	gat	att	ccc	gaa	cgg	atg	cca	atc	tac	cgt	gcc	864
	Ala	Leu	Ile	Val	Gln	Asp	Ile	Pro	Glu	Arg	Met	Pro	Ile	Tyr	Arg	Ala	
			275					280					285				
55	ctg	atc	gag	cag	ttg	gat	gtg	ccc	agc	acc	ctg	atc	gaa	ata	gag	gcc	912
	Leu	Ile	Glu	Gln	Leu	Asp	Val	Pro	Ser	Thr	Leu	Ile	Glu	Ile	Glu	Ala	
			290				295					300					
60	atg	atc	gtg	gac	gtc	aat	acc	gat	ctg	gtc	aac	gag	ctg	ggt	gtc	acc	960
	Met	Ile	Val	Asp	Val	Asn	Thr	Asp	Leu	Val	Asn	Glu	Leu	Gly	Val	Thr	
						310					315				320		
65	tgg	ggg	gcg	cag	atc	gga	acc	acc	agc	ctg	ggc	tat	ggc	gat	ctg	ggg	1008
	Trp	Gly	Ala	Gln	Ile	Gly	Thr	Thr	Ser	Leu	Gly	Tyr	Gly	Asp	Leu	Gly	
					325					330					335		
70	ctg	cgt	ccc	ggc	aac	ggc	ctg	ccc	gtg	gac	ggc	gcg	gcg	gcc	gac	ctg	1056
	Leu	Arg	Pro	Gly	Asn	Gly	Leu	Pro	Val	Asp	Gly	Ala	Ala	Ala	Asp	Leu	
				340					345					350			
75	gcg	ccc	gga	acc	ttg	ggg	atc	agt	gtc	agt	acc	cgg	ctg	gcg	gcg	cgc	1104

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	Ala	Pro	Gly	Thr	Leu	Gly	Ile	Ser	Val	Ser	Thr	Arg	Leu	Ala	Ala	Arg	
			355					360					365				
5	ttg	cgt	gcg	ttg	gag	tcg	gac	ggg	cag	gcc	aat	atc	ctg	tct	cag	ccg	1152
	Leu	Arg	Ala	Leu	Glu	Ser	Asp	Gly	Gln	Ala	Asn	Ile	Leu	Ser	Gln	Pro	
			370				375					380					
10	tcc	atc	ctg	acc	gcc	gac	aac	ctc	ggc	gcc	atg	ata	gac	ctg	tcg	gat	1200
	Ser	Ile	Leu	Thr	Ala	Asp	Asn	Leu	Gly	Ala	Met	Ile	Asp	Leu	Ser	Asp	
						390					395					400	
15	acc	ttc	tac	att	cgc	acc	ctg	ggc	gag	cgc	gta	gcg	aca	gtc	acg	cct	1248
	Thr	Phe	Tyr	Ile	Arg	Thr	Leu	Gly	Glu	Arg	Val	Ala	Thr	Val	Thr	Pro	
					405					410					415		
20	gtc	acg	gtg	ggt	acg	tcg	ttg	cgt	gtg	acg	ccg	cgc	tat	atc	gcc	gcc	1296
	Val	Thr	Val	Gly	Thr	Ser	Leu	Arg	Val	Thr	Pro	Arg	Tyr	Ile	Ala	Ala	
					420				425					430			
25	aag	gga	gga	cgc	cag	gtg	gaa	ttg	gcg	atc	gat	atc	gag	gac	gga	cgg	1344
	Lys	Gly	Gly	Arg	Gln	Val	Glu	Leu	Ala	Ile	Asp	Ile	Glu	Asp	Gly	Arg	
			435				440						445				
30	gtc	ttg	cag	gag	tat	ccc	atc	gat	ggt	ctg	ccc	cgg	gtt	cgg	aaa	agc	1392
	Val	Leu	Gln	Glu	Tyr	Pro	Ile	Asp	Gly	Leu	Pro	Arg	Val	Arg	Lys	Ser	
			450				455					460					
35	agc	atc	agc	acg	ctg	gcg	gtg	gtg	ggg	gac	gag	cag	acg	ctg	ctg	atc	1440
	Ser	Ile	Ser	Thr	Leu	Ala	Val	Val	Gly	Asp	Glu	Gln	Thr	Leu	Leu	Ile	
						470					475					480	
40	ggc	ggc	tac	aac	aat	cgc	cgt	gac	gaa	gag	cag	gtc	gag	aaa	gtg	ccg	1488
	Gly	Gly	Tyr	Asn	Asn	Arg	Arg	Asp	Glu	Glu	Gln	Val	Glu	Lys	Val	Pro	
					485					490					495		
45	ctg	ctg	gga	gat	atc	ccc	ggc	ctg	ggg	ttc	ttg	ttc	tcg	agc	aag	tcc	1536
	Leu	Leu	Gly	Asp	Ile	Pro	Gly	Leu	Gly	Phe	Leu	Phe	Ser	Ser	Lys	Ser	
				500					505					510			
50	cgg	gcg	gta	cag	cgc	cgc	gag	cgg	ctg	ttc	ctg	atc	cgg	ccg	cgt	gtc	1584
	Arg	Ala	Val	Gln	Arg	Arg	Glu	Arg	Leu	Phe	Leu	Ile	Arg	Pro	Arg	Val	
			515				520						525				
55	gtg	gct	atc	gag	ggc	aag	ccg	gtc	ttc	agc	ccc	gtt	gcg	ggc	acg	tcg	1632
	Val	Ala	Ile	Glu	Gly	Lys	Pro	Val	Phe	Ser	Pro	Val	Ala	Gly	Thr	Ser	
			530				535					540					
60	cag	gtg	ttc	atg	agc	acg	ggt	tgg	ggc	ggg	cat	ggc	agc	agc	ctg	agc	1680
	Gln	Val	Phe	Met	Ser	Thr	Gly	Trp	Gly	Gly	His	Gly	Ser	Ser	Leu	Ser	
						550					555					560	
65	att	gca	ccc	ggc	gag	ggc	ggg	cat	aca	caa	gtg	cgt	cat	gat	gcc	cgg	1728
	Ile	Ala	Pro	Gly	Glu	Gly	Gly	His	Thr	Gln	Val	Arg	His	Asp	Ala	Arg	
					565					570					575		
70	gcg	ggc	agg	ccg	gtc	cgg	ctg	gtg	ccg	gat	tca	ttg	cat	gtg	gag	tat	1776
	Ala	Gly	Arg	Pro	Val	Arg	Leu	Val	Pro	Asp	Ser	Leu	His	Val	Glu	Tyr	
				580					585					590			
75	ggc	gag	gcg	ggg	gag	gcg	tcg	ccc	tga								1803

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PCT/EP99/10297

Gly Glu Ala Gly Glu Ala Ser Pro *
 595 600

5 <210> 6
 <211> 600
 <212> PRT
 <213> Bordetella pertussis

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 20 25 30
 15 Pro Leu Ala Pro Tyr Ser Tyr Tyr Ala Gln Gln Gln Ser Leu Ser Asp
 35 40 45
 Val Leu Arg Glu Phe Ala Ala Gly Phe Ser Leu Ala Leu Gln Gln Gly
 50 55 60
 20 Lys Gly Val Gln Gly Val Val Asn Gly Arg Phe Asn Ala Arg Thr Pro
 65 70 75 80
 Thr Glu Phe Ile Glu Arg Leu Ser Gly Ile Tyr Gly Phe Asn Trp Phe
 85 90 95
 Val His Ala Gly Thr Leu Tyr Val Ser Arg Thr Ser Asp Val Val Thr
 100 105 110
 25 Arg Ala Val Asp Ala Ala Gly Ala Ser Pro Ser Ala Leu Arg Gln Ala
 115 120 125
 Leu Leu Gln Leu Gly Ile Leu Asp Glu Arg Phe Gly Trp Gly Glu Leu
 130 135 140
 30 Pro Ala Gln Gly Val Ala Met Val Ser Gly Pro Ala Tyr Val Ala
 145 150 155 160
 Leu Val Glu Gln Ala Val Ala Ala Leu Pro Lys Gly Ala Gly Asn Gln
 165 170 175
 Gln Val Ala Val Phe Arg Leu Lys His Ala Ser Val Ser Asp Arg Val
 180 185 190
 35 Ile Arg Tyr Arg Asp Gln Gln Val Thr Pro Gly Met ala Thr Met
 195 200 205
 Leu Arg Gln Leu Ile Leu Gly Ala Gly Pro Gly Asn Asp Ala Ala Leu
 210 215 220
 40 Ala Ala Val Ala Ala Pro Leu Arg Glu Asn Pro Pro Val Phe Gly Asp
 225 230 235 240
 Ala Ala Ala Asp Gly Asn Ala Pro Leu Ala Gly Ala Ala Gln Ala Ala
 245 250 255
 Gly Arg Arg Leu Ser Glu Pro Ser Val Gln Ala Asp Thr Arg Leu Asn
 260 265 270
 45 Ala Leu Ile Val Gln Asp Ile Pro Glu Arg Met Pro Ile Tyr Arg Ala
 275 280 285
 Leu Ile Glu Gln Leu Asp Val Pro Ser Thr Leu Ile Glu Ile Glu Ala
 290 295 300
 50 Met Ile Val Asp Val Asn Thr Asp Leu Val Asn Glu Leu Gly Val Thr
 305 310 315 320
 Trp Gly Ala Gln Ile Gly Thr Thr Ser Leu Gly Tyr Gly Asp Leu Gly
 325 330 335
 Leu Arg Pro Gly Asn Gly Leu Pro Val Asp Gly Ala Ala Ala Asp Leu
 340 345 350
 55 Ala Pro Gly Thr Leu Gly Ile Ser Val Ser Thr Arg Leu Ala Ala Arg
 355 360 365
 Leu Arg Ala Leu Glu Ser Asp Gly Gln Ala Asn Ile Leu Ser Gln Pro
 370 375 380
 60 Ser Ile Leu Thr Ala Asp Asn Leu Gly Ala Met Ile Asp Leu Ser Asp
 385 390 395 400

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	Thr	Phe	Tyr	Ile	Arg	Thr	Leu	Gly	Glu	Arg	Val	Ala	Thr	Val	Thr	Pro	
				405						410					415		
	Val	Thr	Val	Gly	Thr	Ser	Leu	Arg	Val	Thr	Pro	Arg	Tyr	Ile	Ala	Ala	
				420					425					430			
5	Lys	Gly	Gly	Arg	Gln	Val	Glu	Leu	Ala	Ile	Asp	Ile	Glu	Asp	Gly	Arg	
				435				440					445				
	Val	Leu	Gln	Glu	Tyr	Pro	Ile	Asp	Gly	Leu	Pro	Arg	Val	Arg	Lys	Ser	
				450			455					460					
10	Ser	Ile	Ser	Thr	Leu	Ala	Val	Val	Gly	Asp	Glu	Gln	Thr	Leu	Leu	Ile	
				465		470					475					480	
	Gly	Gly	Tyr	Asn	Asn	Arg	Arg	Asp	Glu	Glu	Gln	Val	Glu	Lys	Val	Pro	
				485					490					495			
	Leu	Leu	Gly	Asp	Ile	Pro	Gly	Leu	Gly	Phe	Leu	Phe	Ser	Ser	Lys	Ser	
				500					505					510			
15	Arg	Ala	Val	Gln	Arg	Arg	Glu	Arg	Leu	Phe	Leu	Ile	Arg	Pro	Arg	Val	
				515				520					525				
	Val	Ala	Ile	Glu	Gly	Lys	Pro	Val	Phe	Ser	Pro	Val	Ala	Gly	Thr	Ser	
				530			535					540					
20	Gln	Val	Phe	Met	Ser	Thr	Gly	Trp	Gly	Gly	His	Gly	Ser	Ser	Leu	Ser	
				545			550				555					560	
	Ile	Ala	Pro	Gly	Glu	Gly	Gly	His	Thr	Gln	Val	Arg	His	Asp	Ala	Arg	
				565					570					575			
	Ala	Gly	Arg	Pro	Val	Arg	Leu	Val	Pro	Asp	Ser	Leu	His	Val	Glu	Tyr	
				580					585					590			
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			595					600									
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	<211> 1281																
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40	Met	Thr	Thr	Ala	Leu	Glu	Phe	Arg	Val	Leu	Ser	Gly	Ala	Gln	Cys	Met	
	1				5					10					15		
	gcg	cgc	tgc	ccg	gcc	gtg	cat	ggc	gcg	cgc	gtg	ggc	gcc	aat	ccg	cat	96
	Ala	Arg	Cys	Pro	Ala	Val	His	Gly	Ala	Arg	Val	Gly	Ala	Asn	Pro	His	
				20					25					30			
45	tgc	gat	atc	gtc	ctg	acc	ggc	gag	gac	atg	ccc	gaa	gtg	gcg	gga	tgg	144
	Cys	Asp	Ile	Val	Leu	Thr	Gly	Glu	Asp	Met	Pro	Glu	Val	Ala	Gly	Trp	
				35				40					45				
50	ctg	gag	atc	gac	cag	tcc	ggc	tgg	cgg	ttg	gcc	ggc	gcc	gtg	acg	ccc	192
	Leu	Glu	Ile	Asp	Gln	Ser	Gly	Trp	Arg	Leu	Ala	Gly	Ala	Val	Thr	Pro	
		50					55					60					
55	ggc	ctg	gac	gcc	cag	gcg	ccg	tgt	ccg	ccc	gcg	gcc	ttc	aac	gaa	ccc	240
	Gly	Leu	Asp	Ala	Gln	Ala	Pro	Cys	Pro	Pro	Ala	Ala	Phe	Asn	Glu	Pro	
		65				70					75					80	
	gta	gag	ctg	gga	gcc	gcc	tgg	atc	acc	gtg	gcc	gcc	cct	tcc	gcg	ccg	288
60	Val	Glu	Leu	Gly	Ala	Ala	Trp	Ile	Thr	Val	Ala	Ala	Pro	Ser	Ala	Pro	
					85					90						95	

5	ttg ccc gcg ccg ccg gag ccg tgc ggc ccg gac ggc agc gac aca gcc	336
	Trp Pro Ala Pro Pro Glu Pro Cys Gly Pro Asp Gly Ser Asp Thr Ala	
	100 105 110	
10	ttg cac gac gtc cct ggc tcg aca agc ccg ccg tcc gtc gct gcc ctc	384
	Leu His Asp Val Pro Gly Ser Thr Ser Pro Pro Ser Val Ala Ala Leu	
	115 120 125	
15	atg ccg cgc cga cgt gca gga ccg ccc tgg ctg gcg ctg ggc gcg gcc	432
	Met Pro Arg Arg Arg Ala Gly Arg Pro Trp Leu Ala Leu Gly Ala Ala	
	130 135 140	
20	gcg gcc gtc ctg ctg gtc ggc ctg gcc acg gcg ctg gtt tcc gtg acc	480
	Ala Ala Val Leu Leu Val Gly Leu Ala Thr Ala Leu Val Ser Val Thr	
	145 150 155 160	
25	aca ccc gcc acg ccg ccg gcc gcg ccg ccc cca acg ccc acc gcg ccg	528
	Thr Pro Ala Thr Pro Pro Ala Ala Pro Pro Pro Thr Pro Thr Ala Pro	
	165 170 175	
30	ctg gtc cgc gcc gcg gcg ctc atc gac agc ctg ggc ctt acc gag caa	576
	Leu Val Arg Ala Ala Ala Leu Ile Asp Ser Leu Gly Leu Thr Glu Gln	
	180 185 190	
35	tta caa gcg gcc tac ggc cgt ggc ggc gtg ctc acc gtg acc gga tgg	624
	Leu Gln Ala Ala Tyr Gly Arg Gly Gly Val Leu Thr Val Thr Gly Trp	
	195 200 205	
40	gtg cac gac gag acg gaa ttc gct ccg gtc gcc agg gcg ttg gcg caa	672
	Val His Asp Glu Thr Glu Phe Ala Arg Val Ala Arg Ala Leu Ala Gln	
	210 215 220	
45	ctt gcg cca ccg cct gcc atg cag gta agc agg cag gac gag gcc agg	720
	Leu Ala Pro Arg Pro Ala Met Gln Val Ser Arg Gln Asp Glu Ala Arg	
	225 230 235 240	
50	gcc ctg gcc tgc gat gtc ctg gcg aca ttc ggg gtg cgc tac atg gcg	768
	Ala Leu Ala Cys Asp Val Leu Ala Thr Phe Gly Val Arg Tyr Met ala	
	245 250 255	
55	cgc ccg tac ggc aat ggc cgc ctg gcg atc tcg ggc atc gcc agc gat	816
	Arg Pro Tyr Gly Asn Gly Arg Leu Ala Ile Ser Gly Ile Ala Ser Asp	
	260 265 270	
60	gcg cac gaa cgc gcc gcg gcg ctg cat gcg gtg cgc atg cgc ctg ccg	864
	Ala His Glu Arg Ala Ala Ala Leu His Ala Val Arg Met Arg Leu Pro	
	275 280 285	
65	ggc atg acg atc ctc ggt cgc gat gta cgc ctg gcc gac gag gtc tcg	912
	Gly Met Thr Ile Leu Gly Arg Asp Val Arg Leu Ala Asp Glu Val Ser	
	290 295 300	
70	gcc cag ttc gcg gcc cag ctg gcc gac gaa cgc ctc gac ggc gtc aag	960
	Ala Gln Phe Ala Ala Gln Leu Ala Asp Glu Arg Leu Asp Gly Val Lys	
	305 310 315 320	
75	ctc agc tgg cac gcc gac cgc ctg gac gca gat ccc ggc gga ttg gcg	1008
	Leu Ser Trp His Ala Asp Arg Leu Asp Ala Asp Pro Gly Gly Leu Ala	
	325 330 335	

	gca ggc cgc atg gcg cgc ctg cgc gag ctg gtg gcc gcg ttc aac cag	1056
	Ala Gly Arg Met ala Arg Leu Arg Glu Leu Val Ala Ala Phe Asn Gln	
5	340 345 350	
	cgc aac tac gac gtc gtc cgg ctg ccg gcc acc gcc gcg cgc gcg acg	1104
	Arg Asn Tyr Asp Val Val Arg Leu Pro Ala Thr Ala Ala Arg Ala Thr	
	355 360 365	
10	cgg gat cac gtg ccg ttc gag ata cgc agt gtc gtg agc ggc ccg caa	1152
	Arg Asp His Val Pro Phe Glu Ile Arg Ser Val Val Ser Gly Pro Gln	
	370 375 380	
15	ccg tac ctg atg ctg gcc gat ggc agc cgc ctc ctg gtg ggc gga ctg	1200
	Pro Tyr Leu Met Leu Ala Asp Gly Ser Arg Leu Leu Val Gly Gly Leu	
	385 390 395 400	
20	cgg gac cag tat cgc ctt acc gcc atc gaa tcc ggc cgc ctg gtc ttc	1248
	Arg Asp Gln Tyr Arg Leu Thr Ala Ile Glu Ser Gly Arg Leu Val Phe	
	405 410 415	
25	gat ggt ccc gaa ccg gtc atc gtg acg cga tga	1281
	Asp Gly Pro Glu Pro Val Ile Val Thr Arg *	
	420 425	
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	<211> 426	
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	20 25 30	
	Cys Asp Ile Val Leu Thr Gly Glu Asp Met Pro Glu Val Ala Gly Trp	
	35 40 45	
40	Leu Glu Ile Asp Gln Ser Gly Trp Arg Leu Ala Gly Ala Val Thr Pro	
	50 55 60	
	Gly Leu Asp Ala Gln Ala Pro Cys Pro Pro Ala Phe Asn Glu Pro	
	65 70 75 80	
	Val Glu Leu Gly Ala Ala Trp Ile Thr Val Ala Ala Pro Ser Ala Pro	
	85 90 95	
45	Trp Pro Ala Pro Pro Glu Pro Cys Gly Pro Asp Gly Ser Asp Thr Ala	
	100 105 110	
	Leu His Asp Val Pro Gly Ser Thr Ser Pro Pro Ser Val Ala Ala Leu	
	115 120 125	
50	Met Pro Arg Arg Arg Ala Gly Arg Pro Trp Leu Ala Leu Gly Ala Ala	
	130 135 140	
	Ala Ala Val Leu Leu Val Gly Leu Ala Thr Ala Leu Val Ser Val Thr	
	145 150 155 160	
	Thr Pro Ala Thr Pro Pro Ala Ala Pro Pro Thr Pro Thr Ala Pro	
	165 170 175	
55	Leu Val Arg Ala Ala Ala Leu Ile Asp Ser Leu Gly Leu Thr Glu Gln	
	180 185 190	
	Leu Gln Ala Ala Tyr Gly Arg Gly Gly Val Leu Thr Val Thr Gly Trp	
	195 200 205	
60	Val His Asp Glu Thr Glu Phe Ala Arg Val Ala Arg Ala Leu Ala Gln	
	210 215 220	

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Leu Ala Pro Arg Pro Ala Met Gln Val Ser Arg Gln Asp Glu Ala Arg
 225 230 235 240
 Ala Leu Ala Cys Asp Val Leu Ala Thr Phe Gly Val Arg Tyr Met ala
 245 250 255
 5 Arg Pro Tyr Gly Asn Gly Arg Leu Ala Ile Ser Gly Ile Ala Ser Asp
 260 265 270
 Ala His Glu Arg Ala Ala Ala Leu His Ala Val Arg Met Arg Leu Pro
 275 280 285
 10 Gly Met Thr Ile Leu Gly Arg Asp Val Arg Leu Ala Asp Glu Val Ser
 290 295 300
 Ala Gln Phe Ala Ala Gln Leu Ala Asp Glu Arg Leu Asp Gly Val Lys
 305 310 315 320
 Leu Ser Trp His Ala Asp Arg Leu Asp Ala Asp Pro Gly Gly Leu Ala
 325 330 335
 15 Ala Gly Arg Met ala Arg Leu Arg Glu Leu Val Ala Ala Phe Asn Gln
 340 345 350
 Arg Asn Tyr Asp Val Val Arg Leu Pro Ala Thr Ala Ala Arg Ala Thr
 355 360 365
 20 Arg Asp His Val Pro Phe Glu Ile Arg Ser Val Val Ser Gly Pro Gln
 370 375 380
 Pro Tyr Leu Met Leu Ala Asp Gly Ser Arg Leu Leu Val Gly Gly Leu
 385 390 395 400
 Arg Asp Gln Tyr Arg Leu Thr Ala Ile Glu Ser Gly Arg Leu Val Phe
 405 410 415
 25 Asp Gly Pro Glu Pro Val Ile Val Thr Arg
 420 425

 <210> 9
 <211> 300
 30 <212> DNA
 <213> Bordetella pertussis

 <220>
 <221> CDS
 35 <222> (1)...(300)

 <400> 9
 atg agt aca tct gtt cta gcc ctg acc gaa ctg gaa gtg cgc ctg gca 48
 Met Ser Thr Ser Val Leu Ala Leu Thr Glu Leu Glu Val Arg Leu Ala
 1 5 10 15
 40 tcg ccg ggc ggt tcc gcc ttg cgc gac acc ttg ctg tcg cag ctt ggc 96
 Ser Pro Gly Gly Ser Ala Leu Arg Asp Thr Leu Leu Ser Gln Leu Gly
 20 25 30
 45 gaa ctg gag aca cgt ttg cgc gtc cgc ctg cac gat ggc gtg ggg cgc 144
 Glu Leu Glu Thr Arg Leu Arg Val Arg Leu His Asp Gly Val Gly Arg
 35 40 45
 50 gac acc tat ccc gta tgg cgc gac gcg ctg gcg gcc gcc acc gcg gcc 192
 Asp Thr Tyr Pro Val Trp Arg Asp Ala Leu Ala Ala Ala Thr Ala Ala
 50 55 60
 55 cgg cag gta ttg ctg cag cgc ccg acc ggg ccg gac aac cct ccg gcg 240
 Arg Gln Val Leu Leu Gln Arg Pro Thr Gly Pro Asp Asn Pro Pro Ala
 65 70 75 80
 60 tca gtc ttg acg cgc ctg agc aat gaa caa tgc gcc gaa gga gac aag 288
 Ser Val Leu Thr Arg Leu Ser Asn Glu Gln Cys Ala Glu Gly Asp Lys
 85 90 95

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cat ggc cat taa
His Gly His *

300

5

<210> 10

<211> 99

<212> PRT

10

<213> Bordetella pertussis

<400> 10

Met Ser Thr Ser Val Leu Ala Leu Thr Glu Leu Glu Val Arg Leu Ala
1 5 10 15
15 Ser Pro Gly Gly Ser Ala Leu Arg Asp Thr Leu Leu Ser Gln Leu Gly
20 25 30
Glu Leu Glu Thr Arg Leu Arg Val Arg Leu His Asp Gly Val Gly Arg
35 40 45
20 Asp Thr Tyr Pro Val Trp Arg Asp Ala Leu Ala Ala Ala Thr Ala Ala
50 55 60
Arg Gln Val Leu Leu Gln Arg Pro Thr Gly Pro Asp Asn Pro Pro Ala
65 70 75 80
Ser Val Leu Thr Arg Leu Ser Asn Glu Gln Cys Ala Glu Gly Asp Lys
85 90 95
25 His Gly His

<210> 11

<211> 267

30

<212> DNA

<213> Bordetella pertussis

<220>

<221> CDS

35

<222> (1)...(267)

<400> 11

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Met ala ile Asn Leu Gly Gly Asp Ala Gly Arg Val Thr Met Gln Ser
1 5 10 15 48
gtc aac cag gcg gtc aat acg cgg ctg aac gct cac gaa cgc gac ctg
Val Asn Gln Ala Val Asn Thr Arg Leu Asn Ala His Glu Arg Asp Leu
20 25 30 96
45 cgc agc cgc ctg gag gcg ctc agc gcg cgc gga gac ggc gcg gtc agc
Arg Ser Arg Leu Glu Ala Leu Ser Ala Arg Gly Asp Gly Ala Val Ser
35 40 45 144
50 acg tcc gac ctg ctg atc gtg caa cag gaa atg caa tcg tgg gtc gtg
Thr Ser Asp Leu Leu Ile Val Gln Gln Glu Met Gln Ser Trp Val Val
50 55 60 192
55 atg atc gat cta cag agc acg gtg gtc aag cag gtc gcg gat tcg ctc
Met ile Asp Leu Gln Ser Thr Val Val Lys Gln Val Ala Asp Ser Leu
65 70 75 80 240
aag ggc gtc ata cag aag gcg agt tga
Lys Gly Val ile Gln Lys Ala Ser *
85 267
60

5 <210> 12
 <211> 88
 <212> PRT
 <213> Bordetella pertussis

10 <400> 12
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 1 5 10 15
 Val Asn Gln Ala Val Asn Thr Arg Leu Asn Ala His Glu Arg Asp Leu
 20 25 30
 Arg Ser Arg Leu Glu Ala Leu Ser Ala Arg Gly Asp Gly Ala Val Ser
 35 40 45
 15 Thr Ser Asp Leu Leu Ile Val Gln Gln Glu Met Gln Ser Trp Val Val
 50 55 60
 Met Ile Asp Leu Gln Ser Thr Val Val Lys Gln Val Ala Asp Ser Leu
 65 70 75 80
 20 Lys Gly Val Ile Gln Lys Ala Ser
 85

25 <210> 13
 <211> 327
 <212> DNA
 <213> Bordetella pertussis

30 <220>
 <221> CDS
 <222> (1)...(327)

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 Met ala Asp Gln Ala Arg Phe Glu Leu Ala Leu Gly Glu Met Pro Gly
 1 5 10 15
 gca tcg gcc ccg aac ggg gcg atc gcc ctg gcg ccg gtc gcg ctc gac 96
 Ala Ser Ala Pro Asn Gly Ala Ile Ala Leu Ala Pro Val Ala Leu Asp
 20 25 30
 40 gag ccg ctg ggc cgt cgc att ctt gga cag ttg cgc ggc ggc ctg gcc 144
 Glu Pro Leu Gly Arg Arg Ile Leu Gly Gln Leu Arg Gly Gly Leu Ala
 35 40 45
 45 gat gtg gca gga aaa tgg cgg gcg gtg cag acg ggc ttg gcc gag gtg 192
 Asp Val Ala Gly Lys Trp Arg Ala Val Gln Thr Gly Leu Ala Glu Val
 50 55 60
 50 agc cag gcg cct acc gtg gtg ggt atg ctc gat ctg cag gcc agg ttg 240
 Ser Gln Ala Pro Thr Val Val Gly Met Leu Asp Leu Gln Ala Arg Leu
 65 70 75 80
 cta cag gca tcc gtg gag tac gag ttg gtg ggc aag gca ata ggg cgc 288
 Leu Gln Ala Ser Val Glu Tyr Glu Leu Val Gly Lys Ala Ile Gly Arg
 85 90 95
 55 gcc acc caa aac gtc gat acg ctg gcg aga atg tca tga 327
 Ala Thr Gln Asn Val Asp Thr Leu Ala Arg Met Ser *
 100 105

60

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<210> 14
 <211> 108
 <212> PRT
 <213> Bordetella pertussis

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<400> 14
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 Glu Pro Leu Gly Arg Arg Ile Leu Gly Gln Leu Arg Gly Gly Leu Ala
 35 40 45
 Asp Val Ala Gly Lys Trp Arg Ala Val Gln Thr Gly Leu Ala Glu Val
 50 55 60
 15 Ser Gln Ala Pro Thr Val Val Gly Met Leu Asp Leu Gln Ala Arg Leu
 65 70 75 80
 Leu Gln Ala Ser Val Glu Tyr Glu Leu Val Gly Lys Ala Ile Gly Arg
 85 90 95
 20 Ala Thr Gln Asn Val Asp Thr Leu Ala Arg Met Ser
 100 105

<210> 15
 <211> 825
 <212> DNA
 <213> Bordetella pertussis

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<220>
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 <222> (1)...(825)

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<400> 15
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 Met Asn Ala Ile Gly Ala Ile Gln Arg Tyr Arg Arg Gly Ala Gly Trp
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 35 gcg gcc ctg gtg ctc gcc ctg gcg ctg ctg gcc ggc tgc ggt gcc cgc 96
 Ala Ala Leu Val Leu Ala Leu Ala Leu Leu Ala Gly Cys Gly Ala Arg
 20 25 30
 40 gtc gag ctg ttg ggc gcg gcg ccc gag aac gaa gcc aac gaa gta ttg 144
 Val Glu Leu Leu Gly Ala Ala Pro Glu Asn Glu Ala Asn Glu Val Leu
 35 40 45
 45 gcg gcg ctg ctc gag gca ggc atc gct gcg cag aag cag tcc ggc aag 192
 Ala Ala Leu Leu Glu Ala Gly Ile Ala Ala Gln Lys Gln Ser Gly Lys
 50 55 60
 50 gcc ggc tac gcg gtt tgc gtg ccg gcc gag gcg gtg gcc cgg tgc ctg 240
 Ala Gly Tyr Ala Val Ser Val Pro Ala Glu Ala Val Ala Arg Ser Leu
 65 70 75 80
 55 gag atc ctg cgc gca agc ggc ctg ccc cgc gag cag ttc gac gga atg 288
 Glu Ile Leu Arg Ala Ser Gly Leu Pro Arg Glu Gln Phe Asp Gly Met
 85 90 95
 60 gga cgc ata ttc cgc aag gaa ggc ctg gtt tca tct ccg ctc gaa gag 336
 Gly Arg Ile Phe Arg Lys Glu Gly Leu Val Ser Ser Pro Leu Glu Glu
 100 105 110
 60 cgc gcc cgc tac att tat gcg ctg tct cag gaa ttg gcc gac acc ctg 384

	Arg	Ala	Arg	Tyr	Ile	Tyr	Ala	Leu	Ser	Gln	Glu	Leu	Ala	Asp	Thr	Leu	
	115							120					125				
5	tcg	cag	atc	gac	ggc	gtg	ctc	agc	gcc	cgc	gtg	cac	gtg	gtg	ctt	ccc	432
	Ser	Gln	Ile	Asp	Gly	Val	Leu	Ser	Ala	Arg	Val	His	Val	Val	Leu	Pro	
	130						135					140					
10	gaa	cgc	ggc	gcg	gtc	ggc	gag	ccg	gcc	acc	cct	tcg	acg	gca	ggg	gtg	480
	Glu	Arg	Gly	Ala	Val	Gly	Glu	Pro	Ala	Thr	Pro	Ser	Thr	Ala	Gly	Val	
	145					150					155					160	
15	ttt	ctc	aag	tac	cgc	gac	gga	cag	agc	ctc	gac	gcg	ctc	gtg	ccc	gag	528
	Phe	Leu	Lys	Tyr	Arg	Asp	Gly	Gln	Ser	Leu	Asp	Ala	Leu	Val	Pro	Glu	
					165					170					175		
20	atc	cgc	aag	ctg	gtc	acg	cat	gcc	atc	ccg	ggc	ctg	gcc	gag	gac	cgt	576
	Ile	Arg	Lys	Leu	Val	Thr	His	Ala	Ile	Pro	Gly	Leu	Ala	Glu	Asp	Arg	
				180				185						190			
25	gta	tcg	gtt	gcc	ctg	gtg	gtg	gcc	cag	ccc	gtt	cag	gcc	gca	ccc	gcg	624
	Val	Ser	Val	Ala	Leu	Val	Val	Ala	Gln	Pro	Val	Gln	Ala	Ala	Pro	Ala	
			195					200					205				
30	ccg	gtc	gcg	tgg	cgc	cgc	gtg	ctt	ggc	gta	cag	gtc	gcg	gac	gga	tcg	672
	Pro	Val	Ala	Trp	Arg	Arg	Val	Leu	Gly	Val	Gln	Val	Ala	Asp	Gly	Ser	
		210					215					220					
35	ata	gtg	gcg	ggg	gcc	gcg	ctc	tac	gtc	tgg	cgc	acg	cgc	tgg	tcc	cgc	720
	Ile	Val	Ala	Gly	Ala	Ala	Leu	Tyr	Val	Trp	Arg	Thr	Arg	Trp	Ser	Arg	
				245					250						255		768
40	ggc	gaa	ggg	cgc	ggc	ggc	gct	ggc	gcc	ggc	gcc	acg	gaa	gga	gcc	ggg	816
	Gly	Glu	Gly	Arg	Gly	Gly	Ala	Gly	Ala	Gly	Ala	Thr	Glu	Gly	Ala	Gly	
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	His	Asp	*														
50	<210>	16															
	<211>	274															
	<212>	PRT															
	<213>	Bordetella pertussis															
55	<400>	16															
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	1			5						10					15		
	Ala	Ala	Leu	Val	Leu	Ala	Leu	Ala	Leu	Ala	Gly	Cys	Gly	Ala	Arg		
				20					25					30			
	Val	Glu	Leu	Leu	Gly	Ala	Ala	Pro	Glu	Asn	Glu	Ala	Asn	Glu	Val	Leu	
			35					40					45				

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Glu Ile Leu Arg Ala Ser Gly Leu Pro Arg Glu Gln Phe Asp Gly Met
 85 90 95
 Gly Arg Ile Phe Arg Lys Glu Gly Leu Val Ser Ser Pro Leu Glu Glu
 100 105 110
 5 Arg Ala Arg Tyr Ile Tyr Ala Leu Ser Gln Glu Leu Ala Asp Thr Leu
 115 120 125
 Ser Gln Ile Asp Gly Val Leu Ser Ala Arg Val His Val Val Leu Pro
 130 135 140
 10 Glu Arg Gly Ala Val Gly Glu Pro Ala Thr Pro Ser Thr Ala Gly Val
 145 150 155 160
 Phe Leu Lys Tyr Arg Asp Gly Gln Ser Leu Asp Ala Leu Val Pro Glu
 165 170 175
 Ile Arg Lys Leu Val Thr His Ala Ile Pro Gly Leu Ala Glu Asp Arg
 180 185 190
 15 Val Ser Val Ala Leu Val Val Ala Gln Pro Val Gln Ala Ala Pro Ala
 195 200 205
 Pro Val Ala Trp Arg Arg Val Leu Gly Val Gln Val Ala Asp Gly Ser
 210 215 220
 20 Val Leu Arg Phe Ser Leu Leu Leu Leu Leu Pro Val Leu Cys Leu
 225 230 235 240
 Ile Val Ala Gly Ala Ala Leu Tyr Val Trp Arg Thr Arg Trp Ser Arg
 245 250 255
 Gly Glu Gly Arg Gly Gly Ala Gly Ala Gly Ala Thr Glu Gly Ala Gly
 260 265 270
 25 His Asp

 <210> 17
 <211> 663
 30 <212> DNA
 <213> Bordetella pertussis

 <220>
 <221> CDS
 35 <222> (1)...(663)

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 1 5 10 15

 ctc ctg ccc agc ctg acc ctg cat gcc agt cgc cac gac gag atg ttt 96
 Leu Leu Pro Ser Leu Thr Leu His Ala Ser Arg His Asp Glu Met Phe
 20 25 30
 45
 cca gcc gat tgg gtg cgc gcg ttg tgc aat gcc gac gcg gcg ttg gcc 144
 Pro Ala Asp Trp Val Arg Ala Leu Cys Asn Ala Asp Ala Ala Leu Ala
 35 40 45
 50
 aac gcg tgg cat cgc cat tgg tgc cgc tgg atc ttg tgc gaa ttg ggc 192
 Asn Ala Trp His Arg His Trp Ser Arg Trp Ile Leu Cys Glu Leu Gly
 50 55 60
 55
 ctg ctg aac cag ccg gtc ctg agc ctc gat ccg ccg cag ttg aag gtc 240
 Leu Leu Asn Gln Pro Val Leu Ser Leu Asp Pro Pro Gln Leu Lys Val
 65 70 75 80
 60
 gcg cta ttg tcc acg gac gcc ttg cgg acc tgc gcc gcc cat gcg gga 288
 Ala Leu Leu Ser Thr Asp Ala Leu Arg Thr Cys Ala Ala His Ala Gly
 85 90 95

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	gcg ctg ctg tgc gcg ccg cgc ctg cga cgc gcg ata gac ggc gcc gag	336
	Ala Leu Leu Cys Ala Pro Arg Leu Arg Arg Ala Ile Asp Gly Ala Glu	
	100 105 110	
5	gtc cgt acc ttg cat gcc gcg ctc ggg cgc gat gtg atg aat ttc gcc	384
	Val Arg Thr Leu His Ala Ala Leu Gly Arg Asp Val Met Asn Phe Ala	
	115 120 125	
10	gtg tct tcc gcg gcg ccg gcc ctg cat gac ggg ctc gcc gcc agt tcg	432
	Val Ser Ser Ala Ala Arg Ala Leu His Asp Gly Leu Ala Ala Ser Ser	
	130 135 140	
15	gac tgg acc ctg gcc gcc acg gtc cag gcg gcg cag aaa ctg ggc tgg	480
	Asp Trp Thr Leu Ala Ala Thr Val Gln Ala Ala Gln Lys Leu Gly Trp	
	145 150 155 160	
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	Ala Leu Leu Arg Asp Ala Val Gln Gly Ala Ala Asp Glu Ile Ala Leu	
	165 170 175	
25	cgt tgc gcg ctg aag ttg ccg cgc gac ctt gat ccc gcg ccc gtc ctg	576
	Arg Cys Ala Leu Lys Leu Pro Arg Asp Leu Asp Pro Ala Pro Val Leu	
	180 185 190	
30	ccg ccc gag gcg gcg ctt gcg ctg gtg ctg tcc atg ctc gaa atc ctg	624
	Pro Pro Glu Ala Ala Leu Ala Leu Val Leu Ser Met Leu Glu Ile Leu	
	195 200 205	
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	20 25 30	
45	Pro Ala Asp Trp Val Arg Ala Leu Cys Asn Ala Asp Ala Ala Leu Ala	
	35 40 45	
	Asn Ala Trp His Arg His Trp Ser Arg Trp Ile Leu Cys Glu Leu Gly	
	50 55 60	
50	Leu Leu Asn Gln Pro Val Leu Ser Leu Asp Pro Pro Gln Leu Lys Val	
	65 70 75 80	
	Ala Leu Leu Ser Thr Asp Ala Leu Arg Thr Cys Ala Ala His Ala Gly	
	85 90 95	
	Ala Leu Leu Cys Ala Pro Arg Leu Arg Arg Ala Ile Asp Gly Ala Glu	
	100 105 110	
55	Val Arg Thr Leu His Ala Ala Leu Gly Arg Asp Val Met Asn Phe Ala	
	115 120 125	
	Val Ser Ser Ala Ala Arg Ala Leu His Asp Gly Leu Ala Ala Ser Ser	
	130 135 140	
60	Asp Trp Thr Leu Ala Ala Thr Val Gln Ala Ala Gln Lys Leu Gly Trp	
	145 150 155 160	

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Ala Leu Leu Arg Asp Ala Val Gln Gly Ala Ala Asp Glu Ile Ala Leu
 165 170 175
 Arg Cys Ala Leu Lys Leu Pro Arg Asp Leu Asp Pro Ala Pro Val Leu
 180 185 190
 5 Pro Pro Glu Ala Ala Leu Ala Leu Val Leu Ser Met Leu Glu Ile Leu
 195 200 205
 Asp Ala Glu Trp Leu Ser Ser Phe Pro Ala Gln Ala
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 Met ala Phe Leu Val Pro Arg Pro Ser Leu Ile Gln Ala Val Arg Pro
 1 5 10 15

25 ggc cgt gcg gat ccc gcg acc gac gtc ttg cgc gct gaa gac tac gcc 96
 Gly Arg Ala Asp Pro Ala Thr Asp Val Leu Arg Ala Glu Asp Tyr Ala
 20 25 30

30 gag ctg ctc agc gcc gcg cag atc gtt gcc cag gca cac cgg cgg gcc 144
 Glu Leu Leu Ser Ala Ala Gln Ile Val Ala Gln Ala His Arg Arg Ala
 35 40 45

35 ggc gaa atc gtg gcc gag gcg cga gag gag ttc gag cgc gag cgc agg 192
 Gly Glu Ile Val Ala Glu Ala Arg Glu Glu Phe Glu Arg Glu Arg Arg
 50 55 60

40 cga ggc tat gag gag ggg cgc cgc gaa gcg ctt acg gat cag gcg gag 240
 Arg Gly Tyr Glu Glu Gly Arg Arg Glu Ala Leu Thr Asp Gln Ala Glu
 65 70 75 80

40 aag atg ata gaa acc gta agc cgc acg atc gac tac ttc gcg ggt atc 288
 Lys Met Ile Glu Thr Val Ser Arg Thr Ile Asp Tyr Phe Ala Gly Ile
 85 90 95

45 gag aac gag atg atc gaa ctg gtc atg agt gcg gtc cgc aag atc gtc 336
 Glu Asn Glu Met Ile Glu Leu Val Met Ser Ala Val Arg Lys Ile Val
 100 105 110

50 gac ggt tac gac gac cgc gag cgc acc gtg atc gcc gtg cgc aac gca 384
 Asp Gly Tyr Asp Asp Arg Glu Arg Thr Val Ile Ala Val Arg Asn Ala
 115 120 125

55 ttg gcg gtc gtg cgc aat cag cgc cag atg acc ttg cgc ctg cac cca 432
 Leu Ala Val Val Arg Asn Gln Arg Gln Met Thr Leu Arg Leu His Pro
 130 135 140

60 gac gag gtg gat gtg ctc cgg gaa ggc atg aac cag ctt ctg gcg gcc 480
 Asp Glu Val Asp Val Leu Arg Glu Gly Met Asn Gln Leu Leu Ala Ala
 145 150 155 160

60 tat ccg ggc gtg ggc tac ctg gac ctg ctg ccc gac gcc agg ctg gcg 528

[illegible]

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<400> 21		
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15	acg atc atc aag gcc gtc gtt ccg atg gtc aag atc ggc gaa gtg tgc Thr Ile Ile Lys Ala Val Val Pro Met Val Lys Ile Gly Glu Val Cys 35 40 45	144
20	ctg ctg cgc aat ccc ggc gag gac ttc gag atg cac ggc gaa gtg gtg Leu Leu Arg Asn Pro Gly Glu Asp Phe Glu Met His Gly Glu Val Val 50 55 60	192
25	ggc ttt gtc cgc gac gcc gcc ttg ctc acg cct atc ggc gac atg tac Gly Phe Val Arg Asp Ala Ala Leu Leu Thr Pro Ile Gly Asp Met Tyr 65 70 75 80	240
30	ggg att tcc tcg gcg acc gag gtg ata ccg acc gga cgc acg cat atg Gly Ile Ser Ser Ala Thr Glu Val Ile Pro Thr Gly Arg Thr His Met 85 90 95	288
35	gtc ccc gtc ggt ccg ggc ttg ctg gga cgc gtg ctg gac ggg ctg gga Val Pro Val Gly Pro Gly Leu Leu Gly Arg Val Leu Asp Gly Leu Gly 100 105 110	336
40	cgt ccg ctg gac gcc gcc gag tca ggg ccg ctg cat gcc cac aag ttc Arg Pro Leu Asp Ala Ala Glu Ser Gly Pro Leu His Ala His Lys Phe 115 120 125	384
45	tat ccg gtc ttc gcc gat gcg cca gac ccg ctg acg cgt cgc atc atc Tyr Pro Val Phe Ala Asp Ala Pro Asp Pro Leu Thr Arg Arg Ile Ile 130 135 140	432
50	cat gct ccg ctg gag ctg ggg gtg cgc gta ctg gac ggt ttg ctt aca His Ala Pro Leu Glu Leu Gly Val Arg Val Leu Asp Gly Leu Leu Thr 145 150 155 160	480
55	tgc ggg gaa ggc cag cgt ctg gga att ttc gca gcc gcc ggc ggc ggc Cys Gly Glu Gly Gln Arg Leu Gly Ile Phe Ala Ala Ala Gly Gly Gly 165 170 175	528
60	aag tcg acc ctg ctg ggc atg ctg gtc aag ggc gcc gcg gtc gac gtg Lys Ser Thr Leu Leu Gly Met Leu Val Lys Gly Ala Ala Val Asp Val 180 185 190	576
65	acg gtg gtg gcg ctg atc ggc gag cgt ggg cgg gaa gtt cgc gag ttc Thr Val Val Ala Leu Ile Gly Glu Arg Gly Arg Glu Val Arg Glu Phe 195 200 205	624
70	ctt gag cac gaa ctc ggt ccg gag ggc aga cgc aag agc gtg atc gtc Leu Glu His Glu Leu Gly Pro Glu Gly Arg Arg Lys Ser Val Ile Val 210 215 220	672
75	tgc gcg acc agc gac aag tcc tcg atg gag cgt gcc aag gcg gcg tac Cys Ala Thr Ser Asp Lys Ser Ser Met Glu Arg Ala Lys Ala Ala Tyr 225 230 235 240	720

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5	gtc gca acc gcc atc gcc gaa tac ttc cgc gat caa ggg cag cgt gta Val Ala Thr Ala Ile Ala Glu Tyr Phe Arg Asp Gln Gly Gln Arg Val 245 250 255	768
10	ctt ttt ctg atg gac tcg gtc acc cgc ttt gcg cga gcc cag cgt gaa Leu Phe Leu Met Asp Ser Val Thr Arg Phe Ala Arg Ala Gln Arg Glu 260 265 270	816
15	atc ggc ttg gcg gca ggc gag ccg ccg acg cgg cgc ggc tat cca ccg Ile Gly Leu Ala Ala Gly Glu Pro Pro Thr Arg Arg Gly Tyr Pro Pro 275 280 285	864
20	tcg gtg ttc gcc acc ttg ccc aaa ctg atg gag cgc gcc ggc atg aac Ser Val Phe Ala Thr Leu Pro Lys Leu Met Glu Arg Ala Gly Met Asn 290 295 300	912
25	cag acg ggt tcg atc acg gcg ctg tat acg gtg ctg gtc gag ggg gac Gln Thr Gly Ser Ile Thr Ala Leu Tyr Thr Val Leu Val Glu Gly Asp 305 310 315 320	960
30	gac atg aac gaa ccg gtg gcc gac gag acg cgt tcg ata ctg gac ggc Asp Met Asn Glu Pro Val Ala Asp Glu Thr Arg Ser Ile Leu Asp Gly 325 330 335	1008
35	cac atc gtg ctc tcg cgc aag ctg gga gcg gcg aat cac tat cct gcc His Ile Val Leu Ser Arg Lys Leu Gly Ala Ala Asn His Tyr Pro Ala 340 345 350	1056
40	gtc gac gtg ctg gcc tcg gcc agc cgg gtc atg aat gcc gtg gtg tcg Val Asp Val Leu Ala Ser Ala Ser Arg Val Met Asn Ala Val Val Ser 355 360 365	1104
45	ccg cgt cac aag tac ctg gcc gga cgt atg cgc gaa ctg atg gcc aag Pro Arg His Lys Tyr Leu Ala Gly Arg Met Arg Glu Leu Met ala Lys 370 375 380	1152
50	tac cag gat gtc gag ctg ttg gtg aaa atc ggc gag tac aag cag ggc Tyr Gln Asp Val Glu Leu Leu Val Lys Ile Gly Glu Tyr Lys Gln Gly 385 390 395 400	1200
55	gcc gat gcg tcg acc gat gag gcg ata cag aag atc gga cag atc aat Ala Asp Ala Ser Thr Asp Glu Ala Ile Gln Lys Ile Gly Gln Ile Asn 405 410 415	1248
60	gcg ttt ctc aga caa cta acc gac gaa cgc gaa gca ttc gag gat acc Ala Phe Leu Arg Gln Leu Thr Asp Glu Arg Glu Ala Phe Glu Asp Thr 420 425 430	1296
65	gta ctg cgc atg gct gaa atc atc gga ccc gaa tcc taa Val Leu Arg Met ala Glu Ile Ile Gly Pro Glu Ser *	1335
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	Met	Arg	Gln	Tyr	His	Tyr	Ile	Thr	Glu	Met	Arg	Val	Ala	Leu	Gln
	1				5				10					15	
	Asp	Leu	Ser	Thr	Leu	Arg	Ile	Lys	Gly	Arg	Val	Val	Gln	Val	Gly
				20					25				30		
5	Thr	Ile	Ile	Lys	Ala	Val	Val	Pro	Met	Val	Lys	Ile	Gly	Glu	Cys
			35					40					45		
	Leu	Leu	Arg	Asn	Pro	Gly	Glu	Asp	Phe	Glu	Met	His	Gly	Glu	Val
	50						55					60			
10	Gly	Phe	Val	Arg	Asp	Ala	Ala	Leu	Leu	Thr	Pro	Ile	Gly	Asp	Met
	65				70						75				80
	Gly	Ile	Ser	Ser	Ala	Thr	Glu	Val	Ile	Pro	Thr	Gly	Arg	Thr	His
				85						90				95	
	Val	Pro	Val	Gly	Pro	Gly	Leu	Leu	Gly	Arg	Val	Leu	Asp	Gly	Leu
				100					105					110	
15	Arg	Pro	Leu	Asp	Ala	Ala	Glu	Ser	Gly	Pro	Leu	His	Ala	His	Lys
			115					120					125		Phe
	Tyr	Pro	Val	Phe	Ala	Asp	Ala	Pro	Asp	Pro	Leu	Thr	Arg	Arg	Ile
	130						135					140			Ile
20	His	Ala	Pro	Leu	Glu	Leu	Gly	Val	Arg	Val	Leu	Asp	Gly	Leu	Leu
	145				150						155				160
	Cys	Gly	Glu	Gly	Gln	Arg	Leu	Gly	Ile	Phe	Ala	Ala	Ala	Gly	Gly
				165						170				175	
	Lys	Ser	Thr	Leu	Leu	Gly	Met	Leu	Val	Lys	Gly	Ala	Ala	Val	Val
				180					185					190	
25	Thr	Val	Val	Ala	Leu	Ile	Gly	Glu	Arg	Gly	Arg	Glu	Val	Arg	Glu
			195					200					205		Phe
	Leu	Glu	His	Glu	Leu	Gly	Pro	Glu	Gly	Arg	Arg	Lys	Ser	Val	Ile
	210						215					220			Val
30	Cys	Ala	Thr	Ser	Asp	Lys	Ser	Ser	Met	Glu	Arg	Ala	Lys	Ala	Tyr
	225				230					235					240
	Val	Ala	Thr	Ala	Ile	Ala	Glu	Tyr	Phe	Arg	Asp	Gln	Gly	Gln	Arg
				245						250					255
	Leu	Phe	Leu	Met	Asp	Ser	Val	Thr	Arg	Phe	Ala	Arg	Ala	Gln	Glu
				260					265					270	
35	Ile	Gly	Leu	Ala	Ala	Gly	Glu	Pro	Pro	Thr	Arg	Arg	Gly	Tyr	Pro
			275					280					285		Pro
	Ser	Val	Phe	Ala	Thr	Leu	Pro	Lys	Leu	Met	Glu	Arg	Ala	Gly	Met
	290						295					300			Asn
40	Gln	Thr	Gly	Ser	Ile	Thr	Ala	Leu	Tyr	Thr	Val	Leu	Val	Glu	Gly
	305				310						315				320
	Asp	Met	Asn	Glu	Pro	Val	Ala	Asp	Glu	Thr	Arg	Ser	Ile	Leu	Asp
				325						330					335
	His	Ile	Val	Leu	Ser	Arg	Lys	Leu	Gly	Ala	Ala	Asn	His	Tyr	Pro
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<213> Bordetella pertussis

<220>

<221> CDS

5 <222> (1)...(510)

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 gcc cag ctt gcg ctg aaa cgc caa cag cag gcc tgc gcg gtt gct gcc 96
 Ala Gln Leu Ala Leu Lys Arg Gln Gln Gln Ala Cys Ala Val Ala Ala
 20 25 30
 gcg gcg cag cgt cag gcg caa ggc cgc ctc gac gat tgt cgc ctg tgg 144
 Ala Ala Gln Arg Gln Ala Gln Gly Arg Leu Asp Asp Cys Arg Leu Trp
 35 40 45
 gcc gga cag ctc gaa aac cgt cta tat gcc gag ctg tgc cgg cgc atc 192
 Ala Gly Gln Leu Glu Asn Arg Leu Tyr Ala Glu Leu Cys Arg Arg Ile
 50 55 60
 gtc aag aca cgc gac atc gac gag gtg ctg caa cga gtg ggc cac gcc 240
 Val Lys Thr Arg Asp Ile Asp Glu Val Leu Gln Arg Val Gly His Ala
 65 70 75 80
 cgc gac cgc cag gcc agc ctg gcg ctg cag ctc gac gac gcc gtg cgc 288
 Arg Asp Arg Gln Ala Ser Leu Ala Leu Gln Leu Asp Asp Ala Val Arg
 85 90 95
 cgt cac gaa cat gaa atc cag ctg ctc gcg cag cag cgc gag cag cac 336
 Arg His Glu His Glu Ile Gln Leu Leu Ala Gln Gln Arg Glu Gln His
 100 105 110
 cgg gag tgc ttc cag gcg cag caa cgg atc gcc gag ttg gtg cgc ctg 384
 Arg Glu Cys Phe Gln Ala Gln Gln Arg Ile Ala Glu Leu Val Arg Leu
 115 120 125
 cag cag gtc gag gcg gcg gcc ttg cgc gag agc cag gaa gat cgc gaa 432
 Gln Gln Val Glu Ala Ala Ala Leu Arg Glu Ser Gln Glu Asp Arg Glu
 130 135 140
 att cag gaa gcc atc gaa ttg tgc gcg cgt ggg cgc gac gat gca tgc 480
 Ile Gln Glu Ala Ile Glu Leu Ser Ala Arg Gly Arg Asp Asp Ala Ser
 145 150 155 160
 cga gcc ggc gac ggc ctg gcg cgg cta tga 510
 Arg Ala Gly Asp Gly Leu Ala Arg Leu *
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<211> 169

<212> PRT

<213> Bordetella pertussis

<400> 24

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 Ala Ala Gln Arg Gln Ala Gln Gly Arg Leu Asp Asp Cys Arg Leu Trp
 35 40 45
 5 Ala Gly Gln Leu Glu Asn Arg Leu Tyr Ala Glu Leu Cys Arg Arg Ile
 50 55 60
 Val Lys Thr Arg Asp Ile Asp Glu Val Leu Gln Arg Val Gly His Ala
 65 70 75 80
 10 Arg Asp Arg Gln Ala Ser Leu Ala Leu Gln Leu Asp Asp Ala Val Arg
 85 90 95
 Arg His Glu His Glu Ile Gln Leu Leu Ala Gln Gln Arg Glu Gln His
 100 105 110
 Arg Glu Cys Phe Gln Ala Gln Gln Arg Ile Ala Glu Leu Val Arg Leu
 115 120 125
 15 Gln Gln Val Glu Ala Ala Ala Leu Arg Glu Ser Gln Glu Asp Arg Glu
 130 135 140
 Ile Gln Glu Ala Ile Glu Leu Ser Ala Arg Gly Arg Asp Asp Ala Ser
 145 150 155 160
 20 Arg Ala Gly Asp Gly Leu Ala Arg Leu
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 <212> DNA
 25 <213> Bordetella pertussis

 <220>
 <221> CDS
 <222> (1)... (549)
 30
 <400> 25
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 Met Asn Gln Pro Asp Gly Leu Gly Ser Pro Met ala Gly Gly Gly Gln
 1 5 10 15
 35 cgc atg ggc gtg gcg cgc acg ccg tat gcg cgt cag ccg gat cgg gat 96
 Arg Met Gly Val Ala Arg Thr Pro Tyr Ala Arg Gln Pro Asp Arg Asp
 20 25 30
 40 gcg cag cgt gcc ttc gag cgg gaa atg gaa cag gag aaa gcg aag gaa 144
 Ala Gln Arg Ala Phe Glu Arg Glu Met Glu Gln Glu Lys Ala Lys Glu
 35 40 45
 45 gaa ctg ccc ggg ccg caa cgc ctg gcg ccg ggt ccg gcc tgc gtc ggc 192
 Glu Leu Pro Gly Pro Gln Arg Leu Ala Pro Gly Pro Ala Cys Val Gly
 50 55 60
 50 tgg ctg gcg tcg atg gaa cct gcc gcc ggc cgt cca ccg gcc agt ctg 240
 Trp Leu Ala Ser Met Glu Pro Ala Ala Gly Arg Pro Pro Ala Ser Leu
 65 70 75 80
 gcc cag gcg ctg gca agc gtg gct gcg ggg ctg gcg gta ggc gac gtg 288
 Ala Gln Ala Leu Ala Ser Val Ala Ala Gly Leu Ala Val Gly Asp Val
 85 90 95
 55 ctg gag ggg tat cgc gaa gcc cgt atc gtt gtg gac gat acg ctg cta 336
 Leu Glu Gly Tyr Arg Glu Ala Arg Ile Val Val Asp Asp Thr Leu Leu
 100 105 110
 60 ccc gac acc acc ttg tcg gta cgg gag gac ggc ggc tgg atc gtg gtg 384

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Pro Asp Thr Thr Leu Ser Val Arg Glu Asp Gly Gly Trp Ile Val Val
 115 120 125

5 gct ttc gca tgc cga caa cgg gac gct tgc gag cgc ctg cac gcg tgc 432
 Ala Phe Ala Cys Arg Gln Arg Asp Ala Cys Glu Arg Leu His Ala Cys
 130 135 140

10 gcc gac cgg ttg gcc atg gag ctc gcg ctg gag ctg gcg cgc gac gtc 480
 Ala Asp Arg Leu Ala Met Glu Leu Ala Leu Glu Leu Ala Arg Asp Val
 145 150 155 160

15 gag gtt gcg gtg gca tgc gac ggc gag ccg cac gag cgg gtg gcg cgc 528
 Glu Val Ala Val Ala Cys Asp Gly Glu Pro His Glu Arg Val Ala Arg
 165 170 175

20 gcg cag cgg ccg tgg cga tga 549
 Ala Gln Arg Pro Trp Arg *
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25 <210> 26
 <211> 182
 <212> PRT
 <213> Bordetella pertussis

30 <400> 26
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 20 25 30
 Ala Gln Arg Ala Phe Glu Arg Glu Met Glu Gln Glu Lys Ala Lys Glu
 35 40 45
 Glu Leu Pro Gly Pro Gln Arg Leu Ala Pro Gly Pro Ala Cys Val Gly
 50 55 60
 35 Trp Leu Ala Ser Met Glu Pro Ala Ala Gly Arg Pro Pro Ala Ser Leu
 65 70 75 80
 Ala Gln Ala Leu Ala Ser Val Ala Ala Gly Leu Ala Val Gly Asp Val
 85 90 95
 40 Leu Glu Gly Tyr Arg Glu Ala Arg Ile Val Val Asp Asp Thr Leu Leu
 100 105 110
 Pro Asp Thr Thr Leu Ser Val Arg Glu Asp Gly Gly Trp Ile Val Val
 115 120 125
 Ala Phe Ala Cys Arg Gln Arg Asp Ala Cys Glu Arg Leu His Ala Cys
 130 135 140
 45 Ala Asp Arg Leu Ala Met Glu Leu Ala Leu Glu Leu Ala Arg Asp Val
 145 150 155 160
 Glu Val Ala Val Ala Cys Asp Gly Glu Pro His Glu Arg Val Ala Arg
 165 170 175
 50 Ala Gln Arg Pro Trp Arg
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55 <210> 27
 <211> 1080
 <212> DNA
 <213> Bordetella pertussis

60 <220>
 <221> CDS
 <222> (1)...(1080)

	<400> 27																
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5	1				5					10					15		
	gat	ctc	gcg	gtt	ccg	cgg	ttg	agc	gcc	ggc	gag	gcc	cat	ggc	ctg	tcg	96
	Asp	Leu	Ala	Val	Pro	Arg	Leu	Ser	Ala	Gly	Glu	Ala	His	Ala	Leu	Ser	
				20					25					30			
10	agg	att	gca	tgc	cat	ggc	gcg	cga	ttc	gac	gtt	cgg	ctt	ggc	gag	ccg	144
	Arg	Ile	Ala	Cys	His	Gly	Ala	Arg	Phe	Asp	Val	Arg	Leu	Gly	Glu	Pro	
			35					40					45				
15	gcc	gtg	cgc	tgg	cac	tgc	gcc	ctg	acg	cct	tgc	gtg	cac	ggc	gac	ctt	192
	Ala	Val	Arg	Trp	His	Cys	Ala	Leu	Thr	Pro	Cys	Val	His	Gly	Asp	Leu	
		50					55					60					
20	gcc	gat	ggc	gag	atg	gaa	agc	ctg	caa	ctg	caa	tgg	gcc	ggg	acg	tac	240
	Ala	Asp	Gly	Glu	Met	Glu	Ser	Leu	Gln	Leu	Gln	Trp	Ala	Gly	Thr	Tyr	
	65					70					75					80	
25	atc	ggc	ctg	acg	gtt	ccg	cgc	gcg	gcc	gcg	gcg	gga	tgg	ctg	gcg	gcg	288
	Ile	Gly	Leu	Thr	Val	Pro	Arg	Ala	Ala	Ala	Ala	Gly	Trp	Leu	Ala	Ala	
					85					90					95		
	cgc	ctg	ccc	cgg	ttt	tcc	ggc	gtg	gag	ttg	ccg	gaa	ccc	att	gcg	gcg	336
	Arg	Leu	Pro	Arg	Phe	Ser	Gly	Val	Glu	Leu	Pro	Glu	Pro	Ile	Ala	Ala	
				100					105					110			
30	gcg	gcc	ctg	gag	gca	atg	ctg	gag	gag	gtc	tgt	cga	ggc	gtg	gcc	gga	384
	Ala	Ala	Leu	Glu	Ala	Met	Leu	Glu	Glu	Val	Cys	Arg	Gly	Val	Ala	Gly	
				115				120					125				
35	ctc	gac	cag	caa	ggc	ccg	gtc	cgc	gtg	gcg	cgg	caa	ggc	ggg	acg	cca	432
	Leu	Asp	Gln	Gln	Gly	Pro	Val	Arg	Val	Ala	Arg	Gln	Gly	Gly	Thr	Pro	
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40	ccg	gtc	cag	ccg	cat	cgc	tgg	acc	ctg	acg	gta	cgg	gcg	cct	gac	ggt	480
	Pro	Val	Gln	Pro	His	Arg	Trp	Thr	Leu	Thr	Val	Arg	Ala	Pro	Asp	Gly	
	145					150					155					160	
45	ggc	gtc	tgg	cgc	gcg	gta	ctg	gcg	tgc	gac	gca	tgg	gcc	ttg	caa	gcg	528
	Gly	Val	Trp	Arg	Ala	Val	Leu	Ala	Cys	Asp	Ala	Trp	Ala	Leu	Gln	Ala	
					165					170					175		
	gtc	gcg	gcg	gcg	ctg	gat	tcc	gtt	gcg	cct	gcc	gat	ggt	cgg	gtc	aat	576
	Val	Ala	Ala	Ala	Leu	Asp	Ser	Val	Ala	Pro	Ala	Asp	Gly	Arg	Val	Asn	
				180					185					190			
50	ccg	gag	cgc	gtg	ccg	gtc	agg	ttg	cgt	gcc	gat	gtc	ggc	gcg	gcg	tcc	624
	Pro	Glu	Arg	Val	Pro	Val	Arg	Leu	Arg	Ala	Asp	Val	Gly	Ala	Ala	Ser	
			195					200					205				
55	gtg	acc	gca	ggc	cag	ctg	cgg	acg	ctg	cga	gcg	ggc	gac	gtc	gtg	ttg	672
	Val	Thr	Ala	Gly	Gln	Leu	Arg	Thr	Leu	Arg	Ala	Gly	Asp	Val	Val	Leu	
		210					215					220					
60	ctc	gcg	cag	tac	cgg	gtg	agc	gat	gcc	gca	gaa	cta	tgg	ttg	tcg	gcc	720
	Leu	Ala	Gln	Tyr	Arg	Val	Ser	Asp	Ala	Ala	Glu	Leu	Trp	Leu	Ser	Ala	
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	atg ttg cgc aac agc cag ccg gcc cag cgt gat ttc ttc ctg cgc aca Met Leu Arg Asn Ser Gln Pro Ala Gln Arg Asp Phe Phe Leu Arg Thr 115 120 125	384	
	gcg cgt cat ctc tgg ggc gag gag gca tcg cgg gac ctg tcg gaa gac Ala Arg His Leu Trp Gly Glu Glu Ala Ser Arg Asp Leu Ser Glu Asp 130 135 140	432	
10	aac ctg ctg gta ttg acg ccc gca ttt ctg gtt tcg gag ctg acc gcc Asn Leu Leu Val Leu Thr Pro Ala Phe Leu Val Ser Glu Leu Thr Ala 145 150 155 160	480	
	gca ttc cag ctt ggc ttt ctg ctg tac ctg ccg ttc atc atc atc gac Ala Phe Gln Leu Gly Phe Leu Leu Tyr Leu Pro Phe Ile Ile Ile Asp 165 170 175	528	
	ctc atc gta tcg aac att ctt ctt gcc atg gga atg atg atg gtt tct Leu Ile Val Ser Asn Ile Leu Leu Ala Met Gly Met Met Met Val Ser 180 185 190	576	
15	ccc gtg acg atc tcc atg ccg ttg aag ctg ttc ctg ttc gtc atg gtg Pro Val Thr Ile Ser Met Pro Leu Lys Leu Phe Leu Phe Val Met Val 195 200 205	624	
	gac ggc tgg acg cgc ctg atc cag ggc ctg gtg ctt tcc tat cgg tga Asp Gly Trp Thr Arg Leu Ile Gln Gly Leu Val Leu Ser Tyr Arg * 210 215 220	672	
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	Ala Val Val Leu Ala Leu Val Arg Asn Ala Leu Gly Val Gln Gln Val 35 40 45 Pro Pro Asn Met ala Leu Tyr Gly Leu Ala Leu Ile Leu Ser Ala Tyr 50 55 60 Val Met ala Pro Val Val His Arg Ile Gly Thr Glu Val Gln Ala Leu 65 70 75 80 Thr Ala Gln Ala Gly Glu Ser Gly Thr Ala Ala Pro Met ala Leu Asp 85 90 95		
	Ala Val Leu Gly Val Ala Glu Arg Gly Val Gly Pro Leu Arg Ala Phe 100 105 110		
30	Met Leu Arg Asn Ser Gln Pro Ala Gln Arg Asp Phe Phe Leu Arg Thr 115 120 125 Ala Arg His Leu Trp Gly Glu Glu Ala Ser Arg Asp Leu Ser Glu Asp 130 135 140 Asn Leu Leu Val Leu Thr Pro Ala Phe Leu Val Ser Glu Leu Thr Ala 145 150 155 160		

Ala Phe Gln Leu Gly Phe Leu Leu Tyr Leu Pro Phe Ile Ile Ile Asp
165 170 175
Leu Ile Val Ser Asn Ile Leu Leu Ala Met Gly Met Met Met Val Ser
180 185 190
5 Pro Val Thr Ile Ser Met Pro Leu Lys Leu Phe Leu Phe Val Met Val
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25 gtg ctc tgg ctg tgc ctg ccg ccc atc gcc gtg gtg gcg atc gtg gga 96
Val Leu Trp Leu Ser Leu Pro Pro Ile Ala Val Val Ala Ile Val Gly
20 25 30

30 acg ctg ttt tcc ctg ttg cag gcc ttg acg cag gtg cag gag cag acc 144
Thr Leu Phe Ser Leu Leu Gln Ala Leu Thr Gln Val Gln Glu Gln Thr
35 40 45

35 ctg tcc ttc gcc gtg aag ctg ata gcc gtg ttc gcc acg ctg atg ctg 192
Leu Ser Phe Ala Val Lys Leu Ile Ala Val Phe Ala Thr Leu Met Leu
50 55 60

gcg gcc cgg tgg ata agc gcg gaa atc tat aac ttc acg att gcg gtg 240
Ala Ala Arg Trp Ile Ser Ala Glu Ile Tyr Asn Phe Thr Ile Ala Val
65 70 75 80

40 ttc gat gcc ttt cat cgg atc cac tga 267
Phe Asp Ala Phe His Arg Ile His *
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20 25 30
55 Thr Leu Phe Ser Leu Leu Gln Ala Leu Thr Gln Val Gln Glu Gln Thr
35 40 45
Leu Ser Phe Ala Val Lys Leu Ile Ala Val Phe Ala Thr Leu Met Leu
50 55 60
60 Ala Ala Arg Trp Ile Ser Ala Glu Ile Tyr Asn Phe Thr Ile Ala Val
65 70 75 80

34

5	tcg ccg gcc atc gtg gcc atg ttc ctg gcc gag ctg ggc ctg gcc ctg	624
	Ser Pro Ala Ile Val Ala Met Phe Leu Ala Glu Leu Gly Leu Ala Leu	
	195 200 205	
	atc agc cgc ttc gcg cct caa ctg cag gtg ttc ttc ctg gct ctg ccg	672
	Ile Ser Arg Phe Ala Pro Gln Leu Gln Val Phe Phe Leu Ala Leu Pro	
10	210 215 220	
	gta aag agc gcg ctg gtg ctg ttc gtg ctg gtg ctg tac atg gca acg	720
	Val Lys Ser Ala Leu Val Leu Phe Val Leu Val Leu Tyr Met ala Thr	
15	225 230 235 240	
	ttg ttc cag tat gca ggc gaa atc ctg ggt tct gtg ggc cgg atc gtg	768
	Leu Phe Gln Tyr Ala Gly Glu Ile Leu Gly Ser Val Gly Arg Ile Val	
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	ccg ttc ctg cat tca gcg tgg ccc ggc cca tga	801
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40	20 25 30	
	Met Phe Asn Arg Gln Phe Leu Pro Gly Pro Leu Arg Tyr Ala Val Gly	
	35 40 45	
45	Ala Cys Leu Gly Leu Ile Val Pro Gln Leu Ala Pro Gln Tyr Ala	
	50 55 60	
	Ala Leu Asp Ile Asp Trp Pro Arg Leu Leu Ala Leu Leu Ala Lys Glu	
50	65 70 75 80	
	Ala Met Val Gly Met Phe Leu Gly Trp Leu Ala Ala Leu Pro Phe Trp	
	85 90 95	
55	Ile Phe Glu Ala Ile Gly Phe Val Ile Asp Asn Gln Arg Gly Ala Ser	
	100 105 110	
	Leu Gly Ala Ile Leu Asn Pro Ala Thr Gly Asn Asp Ser Ser Pro Met	
60	115 120 125	
	Gly Ile Leu Phe Asn Leu Gly Phe Met Val Phe Phe Leu Thr Ala Gly	
	130 135 140	
65	Gly Phe Gly Leu Phe Ala Thr Met Leu Tyr Asp Ser Phe Gly Leu Trp	
	145 150 155 160	
	Asn Ile Trp Ala Trp Trp Pro Ser Met Pro Ala Gln Gly Ala Val Arg	
70	165 170 175	
	Met Leu Asp Gln Phe Ser Gly Phe Ala Ala Arg Val Leu Leu Ala	
	180 185 190	
75	Ser Pro Ala Ile Val Ala Met Phe Leu Ala Glu Leu Gly Leu Ala Leu	
	195 200 205	
	Ile Ser Arg Phe Ala Pro Gln Leu Gln Val Phe Phe Leu Ala Leu Pro	
80	210 215 220	
	Val Lys Ser Ala Leu Val Leu Phe Val Leu Val Leu Tyr Met ala Thr	
	225 230 235 240	
85	Leu Phe Gln Tyr Ala Gly Glu Ile Leu Gly Ser Val Gly Arg Ile Val	
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Pro Phe Leu His Ser Ala Trp Pro Gly Pro
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5 <210> 35
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 <212> DNA
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10 <220>
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 Ser Arg Glu Lys Gly Glu Val Ala His Ser Arg Asp Phe Thr Gln Thr
 20 25 30

25 gcg ctg ata tgc gcc ttg ttc ggg cac ttt ctg atc aat gcc ccg tcc 144
 Ala Leu Ile Cys Ala Leu Phe Gly His Phe Leu Ile Asn Ala Pro Ser
 35 40 45

att ctg gcg tcg ctg cga gcg ctg ata ctg gcg ccg gcg gcc ttt gcc 192
 Ile Leu Ala Ser Leu Arg Ala Leu Ile Leu Ala Pro Ala Ala Phe Ala
 50 55 60

30 gac cag ggg ttc gcc gtc gca ttg ggg ccc gtg ctg acg gaa atc ctc 240
 Asp Gln Gly Phe Ala Val Ala Leu Gly Pro Val Leu Thr Glu Ile Leu
 65 70 75 80

35 gat cag gcc gtc cgc gtg ctc gct ccg ctg att ctc atc gtg ctt ggg 288
 Asp Gln Ala Val Arg Val Leu Ala Pro Leu Ile Leu Ile Val Leu Gly
 85 90 95

40 gtg ggg atg ttc gcc gaa ttc ctg cag gta ggc gtc gtg ctg gcg ttt 336
 Val Gly Met Phe Ala Glu Phe Leu Gln Val Gly Val Val Leu Ala Phe
 100 105 110

45 cga aag ctc aag cct tcg gcg gag aaa ctg aat ccc gcc ggc aat ttg 384
 Arg Lys Leu Lys Pro Ser Ala Glu Lys Leu Asn Pro Ala Gly Asn Leu
 115 120 125

aag aat atc ttc tcg gcg cgc aac ctg atg gag ttc atc aag tcg gta 432
 Lys Asn Ile Phe Ser Ala Arg Asn Leu Met Glu Phe Ile Lys Ser Val
 130 135 140

50 tgc aag atc ctg ttt ctg gcg gtg ttg gtc acg ttg gtg ata cgg gat 480
 Cys Lys Ile Leu Phe Leu Ala Val Leu Val Thr Leu Val Ile Arg Asp
 145 150 155 160

55 tcc ttg cag ccg ctg atg gcc gtt ccc cat agc ggg ctg gac ggg ttg 528
 Ser Leu Gln Pro Leu Met ala Val Pro His Ser Gly Leu Asp Gly Leu
 165 170 175

60 cga acg ggc gta ggc cgc att ctg cag gtc atg gtc tgg aac atc gga 576
 Arg Thr Gly Val Gly Arg Ile Leu Gln Val Met Val Trp Asn Ile Gly
 180 185 190

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	ctg gcg tac ggg gcg att tcg ctg gcg gac ctg gcc tgg cag cgt tac	624
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	195 200 205	
5	cag tat cgc aaa ggc ttg cgg atg agc aag gac gaa gtg aag cag gag	672
	Gln Tyr Arg Lys Gly Leu Arg Met Ser Lys Asp Glu Val Lys Gln Glu	
	210 215 220	
10	tac aag gag atg gaa ggc gat ccc cat atc aag cag caa cgc aag cac	720
	Tyr Lys Glu Met Glu Gly Asp Pro His Ile Lys Gln Gln Arg Lys His	
	225 230 235 240	
15	ctg cac cag gag ctg atc atg cat ggc gcg gcg gcc cag gtt cgc cgg	768
	Leu His Gln Glu Leu Ile Met His Gly Ala Ala Ala Gln Val Arg Arg	
	245 250 255	
20	gcg acg gtg ctg gtg acc aat ccg aca cac ctg gcc gtg gcc ctg tac	816
	Ala Thr Val Leu Val Thr Asn Pro Thr His Leu Ala Val Ala Leu Tyr	
	260 265 270	
25	tac gcg gcg ggc gag acg ccc ttg ccg cgc gtg ctg gcc atg ggg cag	864
	Tyr Ala Ala Gly Glu Thr Pro Leu Pro Arg Val Leu Ala Met Gly Gln	
	275 280 285	
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	Gly Ala Val Ala Ala Leu Met Val Glu Ala Ala Arg Asp Ala Gly Val	
	290 295 300	
30	ccg gtc atg cag aac gtc gcg ctg gcc cgc gcc ttg cac gac cag gcg	960
	Pro Val Met Gln Asn Val Ala Leu Ala Arg Ala Leu His Asp Gln Ala	
	305 310 315 320	
35	gag gtg gac caa tac att ccc ggc gag ttg gtg gag ccg gtg gcc gcg	1008
	Glu Val Asp Gln Tyr Ile Pro Gly Glu Leu Val Glu Pro Val Ala Ala	
	325 330 335	
40	gtg ttg cgg gcg gtg cgc cag gca ctc aag gag cag aca tga	1050
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	<211> 349	
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	Ala Leu Ile Cys Ala Leu Phe Gly His Phe Leu Ile Asn Ala Pro Ser	
	35 40 45	
55	Ile Leu Ala Ser Leu Arg Ala Leu Ile Leu Ala Pro Ala Ala Phe Ala	
	50 55 60	
	Asp Gln Gly Phe Ala Val Ala Leu Gly Pro Val Leu Thr Glu Ile Leu	
	65 70 75 80	
60	Asp Gln Ala Val Arg Val Leu Ala Pro Leu Ile Leu Ile Val Leu Gly	
	85 90 95	

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Val Gly Met Phe Ala Glu Phe Leu Gln Val Gly Val Val Leu Ala Phe
 100 105 110
 Arg Lys Leu Lys Pro Ser Ala Glu Lys Leu Asn Pro Ala Gly Asn Leu
 115 120 125
 5 Lys Asn Ile Phe Ser Ala Arg Asn Leu Met Glu Phe Ile Lys Ser Val
 130 135 140
 Cys Lys Ile Leu Phe Leu Ala Val Leu Val Thr Leu Val Ile Arg Asp
 145 150 155 160
 10 Ser Leu Gln Pro Leu Met ala Val Pro His Ser Gly Leu Asp Gly Leu
 165 170 175
 Arg Thr Gly Val Gly Arg Ile Leu Gln Val Met Val Trp Asn Ile Gly
 180 185 190
 Leu Ala Tyr Gly Ala Ile Ser Leu Ala Asp Leu Ala Trp Gln Arg Tyr
 195 200 205
 15 Gln Tyr Arg Lys Gly Leu Arg Met Ser Lys Asp Glu Val Lys Gln Glu
 210 215 220
 Tyr Lys Glu Met Glu Gly Asp Pro His Ile Lys Gln Gln Arg Lys His
 225 230 235 240
 20 Leu His Gln Glu Leu Ile Met His Gly Ala Ala Ala Gln Val Arg Arg
 245 250 255
 Ala Thr Val Leu Val Thr Asn Pro Thr His Leu Ala Val Ala Leu Tyr
 260 265 270
 Tyr Ala Ala Gly Glu Thr Pro Leu Pro Arg Val Leu Ala Met Gly Gln
 275 280 285
 25 Gly Ala Val Ala Ala Leu Met Val Glu Ala Ala Arg Asp Ala Gly Val
 290 295 300
 Pro Val Met Gln Asn Val Ala Leu Ala Arg Ala Leu His Asp Gln Ala
 305 310 315 320
 30 Glu Val Asp Gln Tyr Ile Pro Gly Glu Leu Val Glu Pro Val Ala Ala
 325 330 335
 Val Leu Arg Ala Val Arg Gln Ala Leu Lys Glu Gln Thr
 340 345

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 Gly Leu Glu Pro Ser Val Asp Ala Asp Gly Gly Leu Ala Val Arg Ile
 20 25 30

 55 gac gga cgg cat cgc gtc agg ttg atc ccc gcc gaa gac ggc atg ctg 144
 Asp Gly Arg His Arg Val Arg Leu Ile Pro Ala Glu Asp Gly Met Leu
 35 40 45

 60 gtg ttg cgg gcg cgg ctg gcc gag ctg ccc gat ggg tgg cag gcg cgc 192
 Val Leu Arg Ala Arg Leu Ala Glu Leu Pro Asp Gly Trp Gln Ala Arg
 50 55 60

 60 gcg gcg cag ttg cgc cgg gcg ggc ctg ctg gcc agc gcc atg gcc cct 240

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Ala Ala Gln Leu Arg Arg Ala Gly Leu Leu Ala Ser Ala Met ala Pro
 65 70 75 80

5 gcg acc gat gcg tac tgc ggc ata gac cag ggc gaa acc gcg ttg tat 288
 Ala Thr Asp Ala Tyr Cys Gly Ile Asp Gln Gly Glu Thr Ala Leu Tyr
 85 90 95

10 ctg cac cag cgc gtc gca ccg gcc ggc agt gcg ctg gcg gtg gac gag 336
 Leu His Gln Arg Val Ala Pro Ala Gly Ser Ala Leu Ala Val Asp Glu
 100 105 110

15 gcg gtg ggc gag ttc gtc aat gcc ttg gcc act tgg aaa agg gcg atg 384
 Ala Val Gly Glu Phe Val Asn Ala Leu Ala Thr Trp Lys Arg Ala Met
 115 120 125

gcg caa tgg caa tag
 Ala Gln Trp Gln * 399
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 Asp Gly Arg His Arg Val Arg Leu Ile Pro Ala Glu Asp Gly Met Leu
 35 35 40 45
 Val Leu Arg Ala Arg Leu Ala Glu Leu Pro Asp Gly Trp Gln Ala Arg
 50 55 60
 35 Ala Ala Gln Leu Arg Arg Ala Gly Leu Leu Ala Ser Ala Met ala Pro
 65 70 75 80
 Ala Thr Asp Ala Tyr Cys Gly Ile Asp Gln Gly Glu Thr Ala Leu Tyr
 85 90 95
 40 Leu His Gln Arg Val Ala Pro Ala Gly Ser Ala Leu Ala Val Asp Glu
 100 105 110
 Ala Val Gly Glu Phe Val Asn Ala Leu Ala Thr Trp Lys Arg Ala Met
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 Ala Gln Trp Gln
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 Met Val Ser Pro Pro Ser Ser Gly Leu Pro Ala Ser Leu Glu Lys Pro
 1 5 10 15

60 gac aac gca tat ccc gat atc gcc acc gag cga tcg gac cag cag ttg 96

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	Asp	Asn	Ala	Tyr	Pro	Asp	Ile	Ala	Thr	Glu	Arg	Ser	Asp	Gln	Gln	Leu	
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5	ctg	agc	agc	ctg	gta	gcc	gaa	cat	gcc	ggc	cga	tta	cag	aga	ttc	atc	144
	Leu	Ser	Ser	Leu	Val	Ala	Glu	His	Ala	Gly	Arg	Leu	Gln	Arg	Phe	Ile	
			35					40					45				
10	gcc	aag	cac	atc	ggc	cac	agc	agc	gac	gtc	gag	gac	ctt	gcg	cag	cag	192
	Ala	Lys	His	Ile	Gly	His	Ser	Ser	Asp	Val	Glu	Asp	Leu	Ala	Gln	Gln	
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15	gct	ttc	gcc	gag	gcg	gcg	cgc	gcg	tat	caa	tcg	ttc	cgt	ggc	gac	tcc	240
	Ala	Phe	Ala	Glu	Ala	Ala	Arg	Ala	Tyr	Gln	Ser	Phe	Arg	Gly	Asp	Ser	
	65				70					75						80	
20	cag	ctt	tcc	acc	tgg	ctg	tac	ggc	atc	gcg	ctc	aat	ctg	gtc	cgc	aat	288
	Gln	Leu	Ser	Thr	Trp	Leu	Tyr	Gly	Ile	Ala	Leu	Asn	Leu	Val	Arg	Asn	
					85					90					95		
25	cac	ttg	tcg	cgt	gcg	cca	gag	cgc	cgt	tat	gaa	ttc	acc	tcc	gac	gcc	336
	His	Leu	Ser	Arg	Ala	Pro	Glu	Arg	Arg	Tyr	Glu	Phe	Thr	Ser	Asp	Ala	
				100					105					110			
30	agc	ctg	ggt	gtc	atg	cca	tgc	agt	gcg	ccc	aac	ccc	gaa	gcc	gtg	acc	384
	Ser	Leu	Gly	Val	Met	Pro	Cys	Ser	Ala	Pro	Asn	Pro	Glu	Ala	Val	Thr	
			115					120					125				
35	gag	cag	cgt	caa	cgc	atg	cgc	ttg	cta	cgc	gaa	gcg	ctg	gag	cag	ctc	432
	Glu	Gln	Arg	Gln	Arg	Met	Arg	Leu	Leu	Arg	Glu	Ala	Leu	Glu	Gln	Leu	
		130					135					140					
40	ccc	gaa	agc	atg	cgc	gac	gtg	atc	ctc	atg	gtc	ggc	gtg	gaa	gaa	ctc	480
	Pro	Glu	Ser	Met	Arg	Asp	Val	Ile	Leu	Met	Val	Gly	Val	Glu	Glu	Leu	
	145					150					155					160	
45	tcc	tat	gaa	gag	gct	gcc	gca	ctg	ctt	tcg	gtt	cct	gta	gga	acc	att	528
	Ser	Tyr	Glu	Glu	Ala	Ala	Ala	Leu	Leu	Ser	Val	Pro	Val	Gly	Thr	Ile	
					165					170					175		
50	cgc	agc	cga	ctt	tcc	cgc	gcc	cgc	tgt	gcc	ttg	cgc	gaa	gcg	ctg	cgc	576
	Arg	Ser	Arg	Leu	Ser	Arg	Ala	Arg	Cys	Ala	Leu	Arg	Glu	Ala	Leu	Arg	
				180					185					190			
55	gaa	cga	ggc	tac	gac	agc	gtg	ccg	tag								603
	Glu	Arg	Gly	Tyr	Asp	Ser	Val	Pro	*								
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	1				5					10					15		
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				20					25					30			
	Leu	Ser	Ser	Leu	Val	Ala	Glu	His	Ala	Gly	Arg	Leu	Gln	Arg	Phe	Ile	
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	Ala	Lys	His	Ile	Gly	His	Ser	Ser	Asp	Val	Glu	Asp	Leu	Ala	Gln	Gln	
	50						55					60					
	Ala	Phe	Ala	Glu	Ala	Ala	Arg	Ala	Tyr	Gln	Ser	Phe	Arg	Gly	Asp	Ser	
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5	Gln	Leu	Ser	Thr	Trp	Leu	Tyr	Gly	Ile	Ala	Leu	Asn	Leu	Val	Arg	Asn	
					85					90					95		
	His	Leu	Ser	Arg	Ala	Pro	Glu	Arg	Arg	Tyr	Glu	Phe	Thr	Ser	Asp	Ala	
				100					105					110			
10	Ser	Leu	Gly	Val	Met	Pro	Cys	Ser	Ala	Pro	Asn	Pro	Glu	Ala	Val	Thr	
			115					120					125				
	Glu	Gln	Arg	Gln	Arg	Met	Arg	Leu	Leu	Arg	Glu	Ala	Leu	Glu	Gln	Leu	
	130						135					140					
	Pro	Glu	Ser	Met	Arg	Asp	Val	Ile	Leu	Met	Val	Gly	Val	Glu	Glu	Leu	
	145					150					155					160	
15	Ser	Tyr	Glu	Glu	Ala	Ala	Ala	Leu	Leu	Ser	Val	Pro	Val	Gly	Thr	Ile	
					165					170					175		
	Arg	Ser	Arg	Leu	Ser	Arg	Ala	Arg	Cys	Ala	Leu	Arg	Glu	Ala	Leu	Arg	
				180					185					190			
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	Met	Thr	Arg	Ile	Asp	Ala	Ala	Pro	Asn	Pro	Phe	His	Ala	Ala	Met	Gln	
35	1				5					10					15		
	ggg	cgc	cac	gac	gcc	tcg	gcc	aac	acc	tcc	tcc	ggc	tgg	ctg	caa	ggc	96
	Gly	Arg	His	Asp	Ala	Ser	Ala	Asn	Thr	Ser	Ser	Gly	Trp	Leu	Gln	Gly	
				20					25					30			
40	cag	cgc	atc	gca	ccg	gcg	ccc	acc	ggc	ata	tcg	ctg	gcg	gac	gcg	gcc	144
	Gln	Arg	Ile	Ala	Pro	Ala	Pro	Thr	Gly	Ile	Ser	Leu	Ala	Asp	Ala	Ala	
				35				40					45				
45	gag	gag	ctc	agc	ctg	cac	atg	gcg	cag	gct	gcc	gag	gaa	aag	cat	cac	192
	Glu	Glu	Leu	Ser	Leu	His	Met	ala	Gln	Ala	Ala	Glu	Glu	Lys	His	His	
	50						55					60					
	tcc	gaa	cgc	aag	gtc	acg	gcc	gaa	cgt	ccg	atg	ctc	tgg	ctg	gac	gcg	240
50	Ser	Glu	Arg	Lys	Val	Thr	Ala	Glu	Arg	Pro	Met	Leu	Trp	Leu	Asp	Ala	
	65					70					75				80		
	gcg	cag	ctt	gcg	gaa	ctg	ttt	tcc	cac	acc	cac	gac	ccc	gac	gcg	cag	288
	Ala	Gln	Leu	Ala	Glu	Leu	Phe	Ser	His	Thr	His	Asp	Pro	Asp	Ala	Gln	
55					85					90				95			
	gca	aaa	ctg	gaa	gcc	ctg	acc	gcc	gag	ctg	ctg	cgc	ggc	cgg	ggc	gcc	336
	Ala	Lys	Leu	Ala	Ala	Leu	Thr	Ala	Glu	Leu	Leu	Arg	Gly	Arg	Gly	Ala	
				100				105					110				
60	ccc	atg	cag	ctg	gcc	gcg	caa	gcg	ttt	ccc	ggt	gtc	acg	cag	caa	tac	384

	Pro	Met	Gln	Leu	Ala	Ala	Gln	Ala	Phe	Pro	Gly	Val	Thr	Gln	Gln	Tyr	
			115					120					125				
5	ctc	gcg	ctg	cag	cac	gcg	ctg	cag	cgc	ggc	gag	cac	gag	gac	gcc	gcg	432
	Leu	Ala	Leu	Gln	His	Ala	Leu	Gln	Arg	Gly	Glu	His	Glu	Asp	Ala	Ala	
			130				135					140					
10	ccg	cac	gcg	ctc	gaa	gcc	ctg	cgc	gat	gca	ttg	gcc	gac	ctg	gag	ctc	480
	Pro	His	Ala	Leu	Glu	Ala	Leu	Arg	Asp	Ala	Leu	Ala	Asp	Leu	Glu	Leu	
						150					155				160		
15	gcc	cat	ggc	ccc	gaa	atc	cgc	gcc	ggc	atc	aac	acc	ctg	ccc	acg	gcc	528
	Ala	His	Gly	Pro	Glu	Ile	Arg	Ala	Gly	Ile	Asn	Thr	Leu	Pro	Thr	Ala	
					165					170					175		
	ggc	gca	ttc	gcg	cgt	tcc	gct	gac	gag	ctg	gcc	ggc	ttc	cag	cac	gcg	576
	Gly	Ala	Phe	Ala	Arg	Ser	Ala	Asp	Glu	Leu	Ala	Gly	Phe	Gln	His	Ala	
					180				185					190			
20	tac	cgc	gac	atc	gcc	ctg	ggc	cag	ctg	tcg	ttg	gcg	cgc	acg	ctg	gac	624
	Tyr	Arg	Asp	Ile	Ala	Leu	Gly	Gln	Leu	Ser	Leu	Ala	Arg	Thr	Leu	Asp	
			195				200						205				
25	ctg	gtg	ctg	gaa	cgc	tat	ggg	aac	gac	gac	atc	cac	ggc	gcg	ctg	ggc	672
	Leu	Val	Leu	Glu	Arg	Tyr	Gly	Asn	Asp	Asp	Ile	His	Gly	Ala	Leu	Gly	
		210					215					220					
30	gcg	ctg	att	cag	gcg	ctg	gga	cac	gac	ctg	gcc	gcg	gcg	aca	ccg	tcg	720
	Ala	Leu	Ile	Gln	Ala	Leu	Gly	His	Asp	Leu	Ala	Ala	Ala	Thr	Pro	Ser	
						230					235				240		
35	acg	gac	ggc	gtc	agg	ctg	caa	gtg	ttg	gcg	agc	gat	ctc	tat	caa	gtc	768
	Thr	Asp	Gly	Val	Arg	Leu	Gln	Val	Leu	Ala	Ser	Asp	Leu	Tyr	Gln	Val	
					245					250					255		
	gag	gtg	gcc	gcc	acg	gta	ctg	gag	gaa	tgc	aat	gcc	ctg	aaa	caa	cg	816
	Glu	Val	Ala	Ala	Thr	Val	Leu	Glu	Glu	Cys	Asn	Ala	Leu	Lys	Gln	Arg	
					260				265					270			
40	ttg	ggc	aac	gca	ggc	tcg	cag	gag	tgt	gcg	gac	gcc	cag	ggc	ctg	atg	864
	Leu	Gly	Asn	Ala	Gly	Ser	Gln	Glu	Cys	Ala	Asp	Ala	Gln	Gly	Leu	Met	
			275				280						285				
45	cgc	gat	ctt	gtg	gga	atc	agc	gag	gac	aaa	tgg	att	gcg	ccc	gcg	cgc	912
	Arg	Asp	Leu	Val	Gly	Ile	Ser	Glu	Asp	Lys	Trp	Ile	Ala	Pro	Ala	Arg	
		290					295					300					
50	ttc	gag	aag	ctg	gcc	gag	cgc	cac	ggt	gcg	aat	gcc	ctc	tcc	gag	cgc	960
	Phe	Glu	Lys	Leu	Ala	Glu	Arg	His	Gly	Ala	Asn	Ala	Leu	Ser	Glu	Arg	
						310					315					320	
55	atc	gca	ttc	ctc	ggt	ggc	gta	cgc	cag	att	ctc	aaa	gac	ctg	ccc	acg	1008
	Ile	Ala	Phe	Leu	Gly	Gly	Val	Arg	Gln	Ile	Leu	Lys	Asp	Leu	Pro	Thr	
					325					330					335		
	cag	atc	tac	gcc	gac	atg	gac	gtg	cgc	gcc	acc	gtc	ctg	gcg	gcc	gcg	1056
	Gln	Ile	Tyr	Ala	Asp	Met	Asp	Val	Arg	Ala	Thr	Val	Leu	Ala	Ala	Ala	
				340					345					350			
60	cag	gac	gcg	ctg	gac	aac	gcg	ata	gca	atg	gag	aac	gca	tga			1098

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Gln Asp Ala Leu Asp Asn Ala Ile Ala Met Glu Asn Ala *
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5 <210> 42
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 <213> Bordetella pertussis

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15 Gln Arg Ile Ala Pro Ala Pro Thr Gly Ile Ser Leu Ala Asp Ala Ala
 35 40 45
 Glu Glu Leu Ser Leu His Met ala Gln Ala Ala Glu Glu Lys His His
 50 55 60
 Ser Glu Arg Lys Val Thr Ala Glu Arg Pro Met Leu Trp Leu Asp Ala
 65 70 75 80

20 Ala Gln Leu Ala Glu Leu Phe Ser His Thr His Asp Pro Asp Ala Gln
 85 90 95
 Ala Lys Leu Glu Ala Leu Thr Ala Glu Leu Leu Arg Gly Arg Gly Ala
 100 105 110

25 Pro Met Gln Leu Ala Ala Gln Ala Phe Pro Gly Val Thr Gln Gln Tyr
 115 120 125
 Leu Ala Leu Gln His Ala Leu Gln Arg Gly Glu His Glu Asp Ala Ala
 130 135 140

30 Pro His Ala Leu Glu Ala Leu Arg Asp Ala Leu Ala Asp Leu Glu Leu
 145 150 155 160
 Ala His Gly Pro Glu Ile Arg Ala Gly Ile Asn Thr Leu Pro Thr Ala
 165 170 175
 Gly Ala Phe Ala Arg Ser Ala Asp Glu Leu Ala Gly Phe Gln His Ala
 180 185 190

35 Tyr Arg Asp Ile Ala Leu Gly Gln Leu Ser Leu Ala Arg Thr Leu Asp
 195 200 205
 Leu Val Leu Glu Arg Tyr Gly Asn Asp Asp Ile His Gly Ala Leu Gly
 210 215 220

40 Ala Leu Ile Gln Ala Leu Gly His Asp Leu Ala Ala Ala Thr Pro Ser
 225 230 235 240
 Thr Asp Gly Val Arg Leu Gln Val Leu Ala Ser Asp Leu Tyr Gln Val
 245 250 255
 Glu Val Ala Ala Thr Val Leu Glu Glu Cys Asn Ala Leu Lys Gln Arg
 260 265 270

45 Leu Gly Asn Ala Gly Ser Gln Glu Cys Ala Asp Ala Gln Gly Leu Met
 275 280 285
 Arg Asp Leu Val Gly Ile Ser Glu Asp Lys Trp Ile Ala Pro Ala Arg
 290 295 300

50 Phe Glu Lys Leu Ala Glu Arg His Gly Ala Asn Ala Leu Ser Glu Arg
 305 310 315 320
 Ile Ala Phe Leu Gly Gly Val Arg Gln Ile Leu Lys Asp Leu Pro Thr
 325 330 335
 Gln Ile Tyr Ala Asp Met Asp Val Arg Ala Thr Val Leu Ala Ala Ala
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15	ccg aga agc aat cgg ctg gcg cct tcc aga ctg tgc gca tac cat tgc	96
	Pro Arg Ser Asn Arg Leu Ala Pro Ser Arg Leu Cys Ala Tyr His Cys	
	20 25 30	
20	cct ctt ttg cca cgc att tgc agc gta tgg ttt ccc ttg cgc ccg acg	144
	Pro Leu Leu Pro Arg Ile Ser Ser Val Trp Phe Pro Leu Arg Pro Thr	
	35 40 45	
25	cag gct cgc ctc gcc atg acc gac acg gca tac cac caa ctc atc gcc	192
	Gln Ala Arg Leu Ala Met Thr Asp Thr Ala Tyr His Gln Leu Ile Ala	
	50 55 60	
30	gat ttc ggc cgc ctc atc ggc atc gac tgc ctc aac ccc ggt gcc ggc	240
	Asp Phe Gly Arg Leu Ile Gly Ile Asp Ser Leu Asn Pro Gly Ala Gly	
	65 70 75 80	
35	ggc ctg tgt cag ttg att ttc gaa ccg tgc gca ccg gtc ttc atc gca	288
	Gly Leu Cys Gln Leu Ile Phe Glu Pro Cys Ala Pro Val Phe Ile Ala	
	85 90 95	
40	ccg gtg cac gcc cgg acg gaa atc atg att tcc tgc gtg ctg ggc acg	336
	Pro Val His Ala Arg Thr Glu Ile Met Ile Ser Cys Val Leu Gly Thr	
	100 105 110	
45	gcg gac gcg gcc aac ccg gca agc atg gcc cga gcc aac ttc atg cag	384
	Ala Asp Ala Ala Asn Pro Ala Ser Met ala Arg Ala Asn Phe Met Gln	
	115 120 125	
50	gcc ggc agc ggc gtc gtg gcc tgc atc ggc ggc gat ggg ttg ttc tat	432
	Ala Gly Ser Gly Val Val Ala Cys Ile Gly Gly Asp Gly Leu Phe Tyr	
	130 135 140	
55	ctg cag cag gcc ata ccc ctg tgc cgc gcc acg ccc gca atc ctg ctc	480
	Leu Gln Gln Ala Ile Pro Leu Ser Arg Ala Thr Pro Ala Ile Leu Leu	
	145 150 155 160	
60	gat cac tgt gag cgt ctg ctg cag gaa gcc tgc cgc tgg cgc gtc ggc	528
	Asp His Cys Glu Arg Leu Leu Gln Glu Ala Ser Arg Trp Arg Val Gly	
	165 170 175	
55	gac cac gac ggc tgc gcc acc tgc gcc ccg aat atc gcc gcg ctg acg	576
	Asp His Asp Gly Cys Ala Thr Ser Ala Pro Asn Ile Ala Leu Thr	
	180 185 190	
60	cgc ggc gtc tag	588
	Arg Gly Val *	
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<400> 44

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50	ctg Leu	caa Gln	ttg Leu	ctt Leu 20	gcg Ala	cac His	cac His	tac Tyr	cag Gln 25	ttg Leu	cag Gln	cgc Arg	caa Gln	tgg Trp 30	agc Ser	aag Lys	96
55	acg Thr	gtt Val	gcc Ala 35	ctg Leu	ctg Leu	gcg Ala	gcc Ala	ctg Leu 40	gat Asp	gcc Ala	ctg Leu	gac Asp	gcg Ala 45	atc Ile	gac Asp	agc Ser	144
60	cag Gln	tcc Ser 50	ctg Leu	ctg Leu	gcc Ala	ctg Leu	gcg Ala 55	ctg Leu	ggc Gly	tat Tyr	ctg Leu	cac His 60	cag Gln	ggc Gly	gaa Glu	ccg Pro	192
60	cgc	atg	gcc	ttg	gtc	acg	ctg	gac	aag	cgc	gca	ctg	cgc	gcc	aca	ccc	240

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	Arg Met ala Leu Val Thr Leu Asp Lys Arg Ala Leu Arg Ala Thr Pro	
	65 70 75 80	
5	gat gcc gcc ggc cat ctg gtc cgg gcg cag gcc atg cag gcg ctg aac Asp Ala Ala Gly His Leu Val Arg Ala Gln Ala Met Gln Ala Leu Asn	288
	85 90 95	
10	cga ccc gac gac gcc cgc cag gcc atg cgt gac tat atg gcg cta cgg Arg Pro Asp Asp Ala Arg Gln Ala Met Arg Asp Tyr Met ala Leu Arg	336
	100 105 110	
15	gcg gcg tct tgc gcg agc gcg acc ccg cca tga Ala Ala Ser Cys Ala Ser Ala Thr Pro Pro *	369
	115 120	
20	<210> 46 <211> 122 <212> PRT <213> Bordetella pertussis	
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55	cgc ggc gtc gac cac atc gtg cgc ggt ccc cgc tgc gag ccc gcc ccc Arg Gly Val Asp His Ile Val Arg Gly Pro Arg Cys Glu Pro Ala Pro 20 25 30	96
60	acc ctg cca ccc gag cgc tgg ctc gaa ccg ccc gcc acc ggc gcg gtc Thr Leu Pro Pro Glu Arg Trp Leu Glu Pro Pro Ala Thr Gly Ala Val 35 40 45	144

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gat cat ctg aaa gcc ctg ctc gta cgc ccg gac ctg agc gcg atg ctc 192
 Asp His Leu Lys Ala Leu Leu Val Arg Pro Asp Leu Ser Ala Met Leu
 50 55 60

5 gac gag tcg gcg cgg cct cgc ctg acg gat ggc gca tta ttc cag ccc 240
 Asp Glu Ser Ala Arg Pro Arg Leu Thr Asp Gly Ala Leu Phe Gln Pro
 65 70 75 80

10 gcg cag ttc gag cgc gcc ctg gcc cag gcg cgc gac gaa ctg tcc cgg 288
 Ala Gln Phe Glu Arg Ala Leu Ala Gln Ala Arg Asp Glu Leu Ser Arg
 85 90 95

15 gcc atg gaa ctg cat gcc ggc aac acc gcg cca gcc tta agc cgc gcc 336
 Ala Met Glu Leu His Ala Gly Asn Thr Ala Pro Ala Leu Ser Arg Ala
 100 105 110

20 ttg cac gta ctc aac gag gcc gga aag ctg cgc gac ctg gct gcc atg 384
 Leu His Val Leu Asn Glu Ala Gly Lys Leu Arg Asp Leu Ala Ala Met
 115 120 125

25 tat cgc agc gcg ctc tac cag gga tga 411
 Tyr Arg Ser Ala Leu Tyr Gln Gly *
 130 135

30 <210> 48
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 <212> PRT
 <213> Bordetella pertussis

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 Thr Leu Pro Pro Glu Arg Trp Leu Glu Pro Pro Ala Thr Gly Ala Val
 35 40 45
 40 Asp His Leu Lys Ala Leu Leu Val Arg Pro Asp Leu Ser Ala Met Leu
 50 55 60
 Asp Glu Ser Ala Arg Pro Arg Leu Thr Asp Gly Ala Leu Phe Gln Pro
 65 70 75 80
 Ala Gln Phe Glu Arg Ala Leu Ala Gln Ala Arg Asp Glu Leu Ser Arg
 85 90 95
 45 Ala Met Glu Leu His Ala Gly Asn Thr Ala Pro Ala Leu Ser Arg Ala
 100 105 110
 Leu His Val Leu Asn Glu Ala Gly Lys Leu Arg Asp Leu Ala Ala Met
 115 120 125
 50 Tyr Arg Ser Ala Leu Tyr Gln Gly
 130 135

55 <210> 49
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 <212> DNA
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 atc gag ggc ctg gca ttc ggg ccg tcc gga tcc gcg tcc ctg gcg ctg 96
 Ile Glu Gly Leu Ala Phe Gly Pro Ser Gly Ser Ala Ser Leu Ala Leu
 20 25 30
 10
 tcc aac ggg cgc cgc ctg ggc gtc gaa tgc gtc gcc ggc gcg gcc ctg 144
 Ser Asn Gly Arg Arg Leu Gly Val Glu Cys Val Ala Gly Ala Ala Leu
 35 40 45
 15
 gtc cac ctg gcc cag cgg gtc gag cgc gac gcc gcc tcc gtg ttg ctg 192
 Val His Leu Ala Gln Arg Val Glu Arg Asp Ala Ala Ser Val Leu Leu
 50 55 60
 20
 gcg gca tgg aaa cgg gcc cat ggg cag cgc gga agc gcc gca tcc atc 240
 Ala Ala Trp Lys Arg Ala His Gly Gln Arg Gly Ser Ala Ala Ser Ile
 65 70 75 80
 25
 cag acg tca ctc tgg tcc gag ggc agc gag gac tgg atc gtc gcg cag 288
 Gln Thr Ser Leu Trp Ser Glu Gly Ser Glu Asp Trp Ile Val Ala Gln
 85 90 95
 30
 aca cga ctg ccc gaa cgc tcc ctc gac gca gcg gcg ttg cgc ctg gcg 336
 Thr Arg Leu Pro Glu Arg Ser Leu Asp Ala Ala Ala Leu Arg Leu Ala
 100 105 110
 35
 gtg ctg ggc ctg acg aac tgg ctc gac cgc ctg gag gcg tga 378
 Val Leu Gly Leu Thr Asn Trp Leu Asp Arg Leu Glu Ala *
 115 120 125
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 Ile Glu Gly Leu Ala Phe Gly Pro Ser Gly Ser Ala Ser Leu Ala Leu
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 Ser Asn Gly Arg Arg Leu Gly Val Glu Cys Val Ala Gly Ala Ala Leu
 35 40 45
 Val His Leu Ala Gln Arg Val Glu Arg Asp Ala Ala Ser Val Leu Leu
 50 55 60
 50
 Ala Ala Trp Lys Arg Ala His Gly Gln Arg Gly Ser Ala Ala Ser Ile
 65 70 75 80
 Gln Thr Ser Leu Trp Ser Glu Gly Ser Glu Asp Trp Ile Val Ala Gln
 85 90 95
 Thr Arg Leu Pro Glu Arg Ser Leu Asp Ala Ala Ala Leu Arg Leu Ala
 100 105 110
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 Val Leu Gly Leu Thr Asn Trp Leu Asp Arg Leu Glu Ala
 115 120 125
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<213> Bordetella pertussis

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<221> CDS

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<400> 51

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15	gtc gcg cgc gcg gtc atg gtt ccc gga aac ggg cgc gat att ggg caa	96
	Val Ala Arg Ala Val Met Val Pro Gly Asn Gly Arg Asp Ile Gly Gln	
	20 25 30	
20	ttc gca gcc tgg aac ttg ccg cgg gcg cag ggt tac tca gca tgc gtc	144
	Phe Ala Ala Trp Asn Leu Pro Arg Ala Gln Gly Tyr Ser Ala Cys Val	
	35 40 45	
25	ttt caa ctc gaa gga gct ctc atg agc att gat ctc gga gtt tca ctc	192
	Phe Gln Leu Glu Gly Ala Leu Met Ser Ile Asp Leu Gly Val Ser Leu	
	50 55 60	
30	acg tcg cag gcc ggc ggc ctg caa ggc atc gac ctc aag agc atg gat	240
	Thr Ser Gln Ala Gly Gly Leu Gln Gly Ile Asp Leu Lys Ser Met Asp	
	65 70 75 80	
35	atc cag act ctc atg gtg tat gtg cag ggt cgt cgc gcc gaa ctc ctc	288
	Ile Gln Thr Leu Met Val Tyr Val Gln Gly Arg Arg Ala Glu Leu Leu	
	85 90 95	
40	acg gct caa atg cag acc cag gcc gaa gtg gtg cag aag gcc aat gaa	336
	Thr Ala Gln Met Gln Thr Gln Ala Glu Val Val Gln Lys Ala Asn Glu	
	100 105 110	
45	cgc atg gcg cag ctc aac gag gtc ctg tcc gcg ctg tcc cgg gcc aag	384
	Arg Met ala Gln Leu Asn Glu Val Leu Ser Ala Leu Ser Arg Ala Lys	
	115 120 125	
50	gcc gag ttt ccg ccc aat ccg aag ccg ggc gac acc atc ccg ggc tgg	432
	Ala Glu Phe Pro Pro Asn Pro Lys Pro Gly Asp Thr Ile Pro Gly Trp	
	130 135 140	
55	gac agc cag aag atc agc cgg atc gag gtt cct ctc aat gat gcg ctg	480
	Asp Ser Gln Lys Ile Ser Arg Ile Glu Val Pro Leu Asn Asp Ala Leu	
	145 150 155 160	
60	cgt gcc gcc ggc ctg acg ggc atg ttc gaa gcg cgc gat ggc cgg gtg	528
	Arg Ala Ala Gly Leu Thr Gly Met Phe Glu Ala Arg Asp Gly Arg Val	
	165 170 175	
55	acc ggc ccc gac ggc cgg ggt acg cag gtc gtg aac ggc acg ggc gtc	576
	Thr Gly Pro Asp Gly Arg Gly Thr Gln Val Val Asn Gly Thr Gly Val	
	180 185 190	
60	atg gcc ggt tcc acg acc tat aag gaa ctc gaa agt gcc tac acc acc	624
	Met ala Gly Ser Thr Thr Tyr Lys Glu Leu Glu Ser Ala Tyr Thr Thr	
	195 200 205	
60	gta aag ggg atg ctg gat acg gcg tcc aat acg caa cag atg gac atg	672

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Val Lys Gly Met Leu Asp Thr Ala Ser Asn Thr Gln Gln Met Asp Met
 210 215 220

5 atc agg ctg cag gcc gcc agc aac aag cgc aac gag gct ttc gag gtc 720
 Ile Arg Leu Gln Ala Ala Ser Asn Lys Arg Asn Glu Ala Phe Glu Val
 225 230 235 240

10 atg acc aac acc gag aag cgg cgc agc gac ttg aac agc tcc atc acc 768
 Met Thr Asn Thr Glu Lys Arg Arg Ser Asp Leu Asn Ser Ser Ile Thr
 245 250 255

15 agc aac atg cgc taa 783
 Ser Asn Met Arg *
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20 <210> 52
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 <213> Bordetella pertussis

25 <400> 52
 Met Gly Ser Pro Arg Arg Arg Asn His Leu Pro Thr Gly Ala Val Ser
 1 5 10 15
 Val Ala Arg Ala Val Met Val Pro Gly Asn Gly Arg Asp Ile Gly Gln
 20 25 30
 Phe Ala Ala Trp Asn Leu Pro Arg Ala Gln Gly Tyr Ser Ala Cys Val
 35 40 45
 30 Phe Gln Leu Glu Gly Ala Leu Met Ser Ile Asp Leu Gly Val Ser Leu
 50 55 60
 Thr Ser Gln Ala Gly Gly Leu Gln Gly Ile Asp Leu Lys Ser Met Asp
 65 70 75 80
 Ile Gln Thr Leu Met Val Tyr Val Gln Gly Arg Arg Ala Glu Leu Leu
 85 90 95
 35 Thr Ala Gln Met Gln Thr Gln Ala Glu Val Val Gln Lys Ala Asn Glu
 100 105 110
 Arg Met ala Gln Leu Asn Glu Val Leu Ser Ala Leu Ser Arg Ala Lys
 115 120 125
 40 Ala Glu Phe Pro Pro Asn Pro Lys Pro Gly Asp Thr Ile Pro Gly Trp
 130 135 140
 Asp Ser Gln Lys Ile Ser Arg Ile Glu Val Pro Leu Asn Asp Ala Leu
 145 150 155 160
 Arg Ala Ala Gly Leu Thr Gly Met Phe Glu Ala Arg Asp Gly Arg Val
 165 170 175
 45 Thr Gly Pro Asp Gly Arg Gly Thr Gln Val Val Asn Gly Thr Gly Val
 180 185 190
 Met ala Gly Ser Thr Thr Tyr Lys Glu Leu Glu Ser Ala Tyr Thr Thr
 195 200 205
 50 Val Lys Gly Met Leu Asp Thr Ala Ser Asn Thr Gln Gln Met Asp Met
 210 215 220
 Ile Arg Leu Gln Ala Ala Ser Asn Lys Arg Asn Glu Ala Phe Glu Val
 225 230 235 240
 Met Thr Asn Thr Glu Lys Arg Arg Ser Asp Leu Asn Ser Ser Ile Thr
 245 250 255

55 Ser Asn Met Arg 260

60 <210> 53
 <211> 276
 <212> DNA

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    <213> Bordetella pertussis
    <220>
    <221> CDS
5    <222> (1)...(276)

    <400> 53
10    atg cag gag caa ggc atc caa tcc atc atg cgc gcc gcg gaa gag ctg      48
      Met Gln Glu Gln Gly Ile Gln Ser Ile Met Arg Ala Ala Glu Glu Leu
        1          5          10          15

      gtc gag cag acc cgc cag gcg ttg tac agc gtc gac gag atc tac gcc      96
      Val Glu Gln Thr Arg Gln Ala Leu Tyr Ser Val Asp Glu Ile Tyr Ala
                20          25          30

15    cac gtt ggc gtc gac ccc gct cgc ctg cgc aat ctg gcg gtc gag cag      144
      His Val Gly Val Asp Pro Ala Arg Leu Arg Asn Leu Ala Val Glu Gln
                35          40          45

20    gcc agg ata gag gcc gag gcc cag gcg gcg ttc cgt gat gac ctc gcg      192
      Ala Arg Ile Glu Ala Glu Ala Gln Ala Ala Phe Arg Asp Asp Leu Ala
                50          55          60

25    gac atc gag cgc gag gcg gcg cgc gtc aag gcg gcc tgc acc gat gcg      240
      Asp Ile Glu Arg Glu Ala Ala Arg Val Lys Ala Ala Cys Thr Asp Ala
        65          70          75          80

30    ccg cag gcc cgc agg gtg ctt cac aac cac gtc tga      276
      Pro Gln Ala Arg Arg Val Leu His Asn His Val *
                85          90

    <210> 54
    <211> 91
35    <212> PRT
    <213> Bordetella pertussis

    <400> 54
40    Met Gln Glu Gln Gly Ile Gln Ser Ile Met Arg Ala Ala Glu Glu Leu
      1          5          10          15
      Val Glu Gln Thr Arg Gln Ala Leu Tyr Ser Val Asp Glu Ile Tyr Ala
                20          25          30
      His Val Gly Val Asp Pro Ala Arg Leu Arg Asn Leu Ala Val Glu Gln
                35          40          45
45    Ala Arg Ile Glu Ala Glu Ala Gln Ala Ala Phe Arg Asp Asp Leu Ala
      50          55          60
      Asp Ile Glu Arg Glu Ala Ala Arg Val Lys Ala Ala Cys Thr Asp Ala
      65          70          75          80
50    Pro Gln Ala Arg Arg Val Leu His Asn His Val
                85          90

    <210> 55
    <211> 942
    <212> DNA
55    <213> Bordetella pertussis

    <220>
    <221> CDS
60    <222> (1)...(942)

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Glu Ala Arg Arg Ala Glu Leu Asp Val Glu Ala Lys Val His Glu Thr
 260 265 270
 Ala Ser Arg Arg Ala Asp Glu Ala Met Gln Gln Met Leu Asp Ile Ile
 275 280 285
 5 Arg Gly Ile Arg Glu Lys Leu Ala Gly Met Glu Gln Ser Arg Ser Glu
 290 295 300
 Thr Ala Arg Ser Val Ala Arg Asn Ile
 305 310

10 <210> 57
 <211> 1203
 <212> DNA
 <213> Bordetella pertussis

15 <220>
 <221> CDS
 <222> (1)...(1203)

20 <400> 57
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 Met Thr Val Met Ser Thr Thr Ile Ser Thr Ala Pro Ser Gly Ala Ala
 1 5 10 15

25 ctt gcg ccg tct cgc ata gat atg cgg gcg ccg gag ccc ggg agt gcc 96
 Leu Ala Pro Ser Arg Ile Asp Met Arg Ala Pro Glu Pro Gly Ser Ala
 20 25 30

30 ggc gaa ggc gcc ggt atc ctg gcg ccg gtg acg acg ctg gct ctg gcg 144
 Gly Glu Gly Ala Gly Ile Leu Ala Pro Val Thr Thr Leu Ala Leu Ala
 35 40 45

35 gcg ggc ccg ccg gct ttg cca gcg tca ccg tcg ctg cgc acc gcg ccc 192
 Ala Gly Arg Pro Ala Leu Pro Ala Ser Pro Ser Leu Arg Thr Ala Pro
 50 55 60

40 gtc ctg gat ccg cca gtg cgc gat ctc agc ccc gcc gac ttg gcc gac 240
 Val Leu Asp Pro Pro Val Arg Asp Leu Ser Pro Ala Asp Leu Ala Asp
 65 70 75 80

45 ctg ctg cgc gtc ttg cga tcc agg gcg gtg gac ggg cag ttg gcc acg 288
 Leu Leu Arg Val Leu Arg Ser Arg Ala Val Asp Gly Gln Leu Ala Thr
 85 90 95

50 gcg cgc gag aac ctg cag gat gcg caa gtc aag gcg aag cag aac acc 336
 Ala Arg Glu Asn Leu Gln Asp Ala Gln Val Lys Ala Lys Gln Asn Thr
 100 105 110

55 cag gcc cag ctc gac aag ctg gac gca tgg ttt ccg aag gct gag gac 384
 Gln Ala Gln Leu Asp Lys Leu Asp Ala Trp Phe Arg Lys Ala Glu Asp
 115 120 125

60 gcc gag agc aag ggc tgg ctg agc aag gtg ttc ggc tgg atc ggg aag 432
 Ala Glu Ser Lys Gly Trp Leu Ser Lys Val Phe Gly Trp Ile Gly Lys
 130 135 140

55 gtg ctg gcg gtc gtg gca tgc gcc ctg gct gtg ggc ttt gct gcc gtc 480
 Val Leu Ala Val Val Ala Ser Ala Leu Ala Val Gly Phe Ala Ala Val
 145 150 155 160

60 gcc agc gtg gtc acc ggc gcg gcg gcc acg ccc atg ctg gtg ctc agc 528

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	Ala Ser Val Val Thr Gly Ala Ala Ala Thr Pro Met Leu Val Leu Ser	
	165 170 175	
5	ggc atg gca ttg gtc agc gcc gtg aca tcg ctg gcc gac cag ata tcg Gly Met ala Leu Val Ser Ala Val Thr Ser Leu Ala Asp Gln Ile Ser	576
	180 185 190	
10	cga gag gcg gga ggg ccg cct atc agc ctg gcc ggg ttt ctc tcc ggg Arg Glu Ala Gly Gly Pro Pro Ile Ser Leu Gly Gly Phe Leu Ser Gly	624
	195 200 205	
15	ctg gcc gga cgt ctg ctg aca gcg ttg ggg gtg gat cag tcg cag gcc Leu Ala Gly Arg Leu Leu Thr Ala Leu Gly Val Asp Gln Ser Gln Ala	672
	210 215 220	
20	gac caa att gcc aag atc gtc gcc ggc ctg gcc gtg ccc gcc gtc ttg Asp Gln Ile Ala Lys Ile Val Ala Gly Leu Ala Val Pro Ala Val Leu	720
	225 230 235 240	
25	ctg atc gaa ccc cag atg ctg gcc gaa atg gcc gaa ggc gtg gcc agg Leu Ile Glu Pro Gln Met Leu Gly Glu Met ala Glu Gly Val Ala Arg	768
	245 250 255	
30	ctg gcg ggc gcc ggc gat gcc acc gcg gga tac ata gcc atg gcg atg Leu Ala Gly Ala Gly Asp Ala Thr Ala Gly Tyr Ile Ala Met ala Met	816
	260 265 270	
35	tcc atc gtg gcg gcg atc gcg gtc gcc gcg atc aat gcc gcc ggt acg Ser Ile Val Ala Ala Ile Ala Val Ala Ala Ile Asn Ala Ala Gly Thr	864
	275 280 285	
40	gcc ggc gcg ggc agc gcc tcg gcg atc agg ggt gcc tgg gat cgg gcc Ala Gly Ala Gly Ser Ala Ser Ala Ile Arg Gly Ala Trp Asp Arg Ala	912
	290 295 300	
45	gcc gcg gta gcc acc cag gtc ctt cag ggg ggt acg gca gtg gcg caa Ala Ala Val Ala Thr Gln Val Leu Gln Gly Gly Thr Ala Val Ala Gln	960
	305 310 315 320	
50	ggc ggc gtc ggc gtg tcg atg gca gtc gat cgc aaa cag gcc gat ctc Gly Gly Val Gly Val Ser Met ala Val Asp Arg Lys Gln Ala Asp Leu	1008
	325 330 335	
55	ctg gtc gcc gac aag gcg gat ctg gcg gcg agc ctg aca aaa ctg cgg Leu Val Ala Asp Lys Ala Asp Leu Ala Ala Ser Leu Thr Lys Leu Arg	1056
	340 345 350	
60	gcg gcc atg gag cgt gag gcg gac gat atc aag aag atc ctg gct caa Ala Ala Met Glu Arg Glu Ala Asp Asp Ile Lys Lys Ile Leu Ala Gln	1104
	355 360 365	
65	ttc gac gcg gcc tat cac atg atc gcg cag atg atc agc gac atg gcg Phe Asp Ala Ala Tyr His Met Ile Ala Gln Met Ile Ser Asp Met ala	1152
	370 375 380	
70	agc acg cac agc cag gtc agc gcc aac ctc gga cgg cgc cag gcg gtg Ser Thr His Ser Gln Val Ser Ala Asn Leu Gly Arg Arg Gln Ala Val	1200
	385 390 395 400	
75	tag	1203

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<210> 58
 <211> 400
 <212> PRT
 5 <213> Bordetella pertussis

 <400> 58
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 1 5 10 15
 10 Leu Ala Pro Ser Arg Ile Asp Met Arg Ala Pro Glu Pro Gly Ser Ala
 20 25 30
 Gly Glu Gly Ala Gly Ile Leu Ala Pro Val Thr Thr Leu Ala Leu Ala
 35 40 45
 15 Ala Gly Arg Pro Ala Leu Pro Ala Ser Pro Ser Leu Arg Thr Ala Pro
 50 55 60
 Val Leu Asp Pro Pro Val Arg Asp Leu Ser Pro Ala Asp Leu Ala Asp
 65 70 75 80
 Leu Leu Arg Val Leu Arg Ser Arg Ala Val Asp Gly Gln Leu Ala Thr
 85 90 95
 20 Ala Arg Glu Asn Leu Gln Asp Ala Gln Val Lys Ala Lys Gln Asn Thr
 100 105 110
 Gln Ala Gln Leu Asp Lys Leu Asp Ala Trp Phe Arg Lys Ala Glu Asp
 115 120 125
 25 Ala Glu Ser Lys Gly Trp Leu Ser Lys Val Phe Gly Trp Ile Gly Lys
 130 135 140
 Val Leu Ala Val Val Ala Ser Ala Leu Ala Val Gly Phe Ala Ala Val
 145 150 155 160
 Ala Ser Val Val Thr Gly Ala Ala Ala Thr Pro Met Leu Val Leu Ser
 165 170 175
 30 Gly Met ala Leu Val Ser Ala Val Thr Ser Leu Ala Asp Gln Ile Ser
 180 185 190
 Arg Glu Ala Gly Gly Pro Pro Ile Ser Leu Gly Gly Phe Leu Ser Gly
 195 200 205
 35 Leu Ala Gly Arg Leu Leu Thr Ala Leu Gly Val Asp Gln Ser Gln Ala
 210 215 220
 Asp Gln Ile Ala Lys Ile Val Ala Gly Leu Ala Val Pro Ala Val Leu
 225 230 235 240
 Leu Ile Glu Pro Gln Met Leu Gly Glu Met ala Glu Gly Val Ala Arg
 245 250 255
 40 Leu Ala Gly Ala Gly Asp Ala Thr Ala Gly Tyr Ile Ala Met ala Met
 260 265 270
 Ser Ile Val Ala Ala Ile Ala Val Ala Ala Ile Asn Ala Ala Gly Thr
 275 280 285
 45 Ala Gly Ala Gly Ser Ala Ser Ala Ile Arg Gly Ala Trp Asp Arg Ala
 290 295 300
 Ala Ala Val Ala Thr Gln Val Leu Gln Gly Gly Thr Ala Val Ala Gln
 305 310 315 320
 Gly Gly Val Gly Val Ser Met ala Val Asp Arg Lys Gln Ala Asp Leu
 325 330 335
 50 Leu Val Ala Asp Lys Ala Asp Leu Ala Ala Ser Leu Thr Lys Leu Arg
 340 345 350
 Ala Ala Met Glu Arg Glu Ala Asp Asp Ile Lys Lys Ile Leu Ala Gln
 355 360 365
 55 Phe Asp Ala Ala Tyr His Met Ile Ala Gln Met Ile Ser Asp Met ala
 370 375 380
 Ser Thr His Ser Gln Val Ser Ala Asn Leu Gly Arg Arg Gln Ala Val
 385 390 395 400

 <210> 59
 60 <211> 462

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35 40 45
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 50 55 60
 Tyr Trp Ala Gly Leu Ala Leu Cys Leu Gln Lys Thr Asp Arg Pro Asp
 65 70 75 80
 Glu Ala Arg Asn Ile Tyr Ala Leu Ile Leu Thr Leu Tyr Pro Asp Ser
 85 90 95
 Ala Asp Ala Val Leu Arg Thr Ala Glu Cys Glu Leu Ala Leu Gly Glu
 100 105 110
 10 Asn Glu Arg Ala Gln Ala Ala Leu Phe Gly Ala Ile Ala Ile Asp Ala
 115 120 125
 Glu Ser Gly Gln Pro Gly Pro Val Ser His Arg Ala Arg Ala Leu Leu
 130 135 140
 15 Asp Leu Ile Ser Val Ser His Pro Glu
 145 150

 <210> 61
 <211> 522
 <212> DNA
 20 <213> Bordetella pertussis

 <220>
 <221> CDS
 <222> (1)...(522)
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 <400> 61
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 1 5 10 15
 30 tca ccc atg gtc tcg tcg ata cat cca tcg gaa ccg ata cag ccg atg 96
 Ser Pro Met Val Ser Ser Ile His Pro Ser Glu Pro Ile Gln Pro Met
 20 25 30
 35 gag cat gtg ctc gag gag gcc gac gcc cgc ctg ctt acc gaa gtg ggt 144
 Glu His Val Leu Glu Glu Ala Asp Ala Arg Leu Leu Thr Glu Val Gly
 35 40 45
 40 ttt ctg gcg gcg gcc gtc agc gat ctg acg cgc gcg gac gcc att ttc 192
 Phe Leu Ala Ala Ala Val Ser Asp Leu Thr Arg Ala Asp Ala Ile Phe
 50 55 60
 45 aat gca ttg caa cgt gta cgg ccg ggc cgg acg cat ccc tgc atc ggc 240
 Asn Ala Leu Gln Arg Val Arg Pro Gly Arg Thr His Pro Cys Ile Gly
 65 70 75 80
 ctg gcg gtc gcc cgc atg aac gcc ggg ctg ccc gac gaa gcc gcc gag 288
 Leu Ala Val Ala Arg Met Asn Ala Gly Leu Pro Asp Glu Ala Ala Glu
 85 90 95
 50 atc ctg gcg aat ttc cag ccg gca cag ccg gag gac cgc tcg gaa ctg 336
 Ile Leu Ala Asn Phe Gln Pro Ala Gln Pro Glu Asp Arg Ser Glu Leu
 100 105 110
 55 gac gcc tgg tgc ggg ttc gct ctg ttg ctg gct ggc cgc tcg gac gag 384
 Asp Ala Trp Cys Gly Phe Ala Leu Leu Leu Ala Gly Arg Ser Asp Glu
 115 120 125
 60 gcg cgc cgc atg ctg cag cga gcc atc gat gcg ggt ggc gag gcg gca 432
 Ala Arg Arg Met Leu Gln Arg Ala Ile Asp Ala Gly Gly Glu Ala Ala

	130	135	140	
5	agg ctg gcg cag gtc gtg ttg gac agc gga ccc gcc atg atg cgG ccc Arg Leu Ala Gln Val Val Leu Asp Ser Gly Pro Ala Met Met Arg Pro 145 150 155 160			480
10	gcg ccg ttg cag tcc gag cca tta cct gga gct cct gga tga Ala Pro Leu Gln Ser Glu Pro Leu Pro Gly Ala Pro Gly * 165 170			522
15	<210> 62 <211> 173 <212> PRT <213> Bordetella pertussis			
20	<400> 62 Met His Ser Asp Ser Gly Ser Asp Ser Gly Ser Asp Ser Gly Ser Gly 1 5 10 15 Ser Pro Met Val Ser Ser Ile His Pro Ser Glu Pro Ile Gln Pro Met 20 25 30 Glu His Val Leu Glu Glu Ala Asp Ala Arg Leu Leu Thr Glu Val Gly 35 40 45 Phe Leu Ala Ala Ala Val Ser Asp Leu Thr Arg Ala Asp Ala Ile Phe 50 55 60 Asn Ala Leu Gln Arg Val Arg Pro Gly Arg Thr His Pro Cys Ile Gly 65 70 75 80 Leu Ala Val Ala Arg Met Asn Ala Gly Leu Pro Asp Glu Ala Ala Glu 85 90 95 Ile Leu Ala Asn Phe Gln Pro Ala Gln Pro Glu Asp Arg Ser Glu Leu 100 105 110 Asp Ala Trp Cys Gly Phe Ala Leu Leu Leu Ala Gly Arg Ser Asp Glu 115 120 125 Ala Arg Arg Met Leu Gln Arg Ala Ile Asp Ala Gly Gly Glu Ala Ala 35 130 135 140 Arg Leu Ala Gln Val Val Leu Asp Ser Gly Pro Ala Met Met Arg Pro 145 150 155 160 Ala Pro Leu Gln Ser Glu Pro Leu Pro Gly Ala Pro Gly 165 170			
40	<210> 63 <211> 180 <212> DNA <213> Bordetella pertussis			
45	<220> <221> CDS <222> (1)...(180)			
50	<400> 63 atg gtt gcg cga ggt cct tgc gca cca cct ggt gta gtc ccc ata cgt Met Val Ala Arg Gly Pro Cys Ala Pro Pro Gly Val Val Pro Ile Arg 1 5 10 15			48
55	cgc gtc gta agt ttt acg gaa gac gtt cag cgc gtt gta tct gaa tgc Arg Val Val Ser Phe Thr Glu Asp Val Gln Arg Val Val Ser Glu Cys 20 25 30			96
60	tcc ggt agc gac cgc gat ccg aca tta gtt tcg gaa gtt aac aac tgc Ser Gly Ser Asp Arg Asp Pro Thr Leu Val Ser Glu Val Asn Asn Cys			144

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35 40 45

5 cgg ata aaa ccg gca gtc agt atc ttg gtg acg tga 180
 Arg Ile Lys Pro Ala Val Ser Ile Leu Val Thr *
 50 55

10 <210> 64
 <211> 59
 <212> PRT
 <213> Bordetella pertussis

15 <400> 64
 Met Val Ala Arg Gly Pro Cys Ala Pro Pro Gly Val Val Pro Ile Arg
 1 5 10 15
 Arg Val Val Ser Phe Thr Glu Asp Val Gln Arg Val Val Ser Glu Cys
 20 25 30
 Ser Gly Ser Asp Arg Asp Pro Thr Leu Val Ser Glu Val Asn Asn Cys
 35 40 45
 20 Arg Ile Lys Pro Ala Val Ser Ile Leu Val Thr
 50 55

25 <210> 65
 <211> 975
 <212> DNA
 <213> Bordetella pertussis

30 <220>
 <221> CDS
 <222> (1)...(975)

35 <400> 65
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 Met Arg Phe Arg Ala Gly Tyr Ser Arg Tyr Gln Ala Arg Ser Gly His
 1 5 10 15

40 ggg gac cgc cca ccc ccc gca cag gcg cgc gtc cag acg gta ctc ctg 96
 Gly Asp Arg Pro Pro Pro Ala Gln Ala Arg Val Gln Thr Val Leu Leu
 20 25 30

45 cac gga ctc tcc gcg ttg acg gcg caa gtt gcg cag cgc ttc gaa atg 144
 His Gly Leu Ser Ala Leu Thr Ala Gln Val Ala Gln Arg Phe Glu Met
 35 40 45

50 gcg cgc cac cgg atg gct ggc ccc ggt cgc acg aca ggc cac cac cat 192
 Ala Arg His Arg Met ala Gly Pro Gly Arg Thr Thr Gly His His His
 50 55 60

55 ttc cag ctc gag gcc cag cgt atg gcc gac act ttg cgc agc gtt caa 240
 Phe Gln Leu Glu Ala Gln Arg Met ala Asp Thr Leu Arg Ser Val Gln
 65 70 75 80

60 ggc gag cct cgg tgg ccg gac ggg agc gag gcc tgc atg ccg tcg ggt 288
 Gly Glu Pro Arg Trp Pro Asp Gly Ser Glu Ala Cys Met Pro Ser Gly
 85 90 95

60 ttg tca tgc cgg cat gga acc gaa gag ccg aaa gcg tca cac agt gca 336
 Leu Ser Cys Arg His Gly Thr Glu Glu Pro Lys Ala Ser His Ser Ala
 100 105 110

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	tat tcc atg ttc ccg ctc cgt aga acg cga tac acc caa gga ttc gag	384
	Tyr Ser Met Phe Pro Leu Arg Arg Thr Arg Tyr Thr Gln Gly Phe Glu	
	115 120 125	
5	aca acg gcc cac cgc atg aac ttc cag atc cca ccc gct tta cct gct	432
	Thr Thr Ala His Arg Met Asn Phe Gln Ile Pro Pro Ala Leu Pro Ala	
	130 135 140	
10	ttg gag ctt gat gtc ttt gcg cgc gcc gcc agc caa gga gag acc cta	480
	Leu Glu Leu Asp Val Phe Ala Arg Ala Ala Ser Gln Gly Glu Thr Leu	
	145 150 155 160	
15	tat gtc acc aaa gca ggc gag cag ttc cag gtc atc gca tcc ggc acg	528
	Tyr Val Thr Lys Ala Gly Glu Gln Phe Gln Val Ile Ala Ser Gly Thr	
	165 170 175	
20	acg ccg tca ggg cgc aac gta tcc tgg gtc gcc acc gac gag gac acg	576
	Thr Pro Ser Gly Arg Asn Val Ser Trp Val Ala Thr Asp Glu Asp Thr	
	180 185 190	
25	ctt gtc atg ttt tcc agc gcg ctg gcg ctg gcc tac ggc acg gga atc	624
	Leu Val Met Phe Ser Ser Ala Leu Ala Leu Ala Tyr Gly Thr Gly Ile	
	195 200 205	
30	gcc cgc gcc gtc gcc aag gag ctc gat ctg cac gcg gtc ccg acg aca	672
	Ala Arg Ala Val Ala Lys Glu Leu Asp Leu His Ala Val Pro Thr Thr	
	210 215 220	
35	tcg ctg tcg gcg cgc gtc gtc acg cga gcg gtc gac atg gcg gaa acc	720
	Ser Leu Ser Ala Arg Val Val Thr Arg Ala Val Asp Met ala Glu Thr	
	225 230 235 240	
40	tca cgc cac gcc ctg cag ggc gtg gat ttc ctt acc ttc ctg tcc tgg	768
	Ser Arg His Ala Leu Gln Gly Val Asp Phe Leu Thr Phe Leu Ser Trp	
	245 250 255	
45	tcg gcc cgc gcc gac gcc gcc ggc ttc cga cag gtc tgt cac gac acc	816
	Ser Ala Arg Ala Asp Ala Ala Gly Phe Arg Gln Val Cys His Asp Thr	
	260 265 270	
50	ggg gtc tct ccc gat cag ata tcc gga acg ttg cgc gcc acg atc gac	864
	Gly Val Ser Pro Asp Gln Ile Ser Gly Thr Leu Arg Ala Thr Ile Asp	
	275 280 285	
55	gaa agc atg cag cag cgc ttc gca tcc gcc gca caa tca ggt aag gcg	912
	Glu Ser Met Gln Gln Arg Phe Ala Ser Ala Ala Gln Ser Gly Lys Ala	
	290 295 300	
60	ccg gta tcc gcc cat acg gcg caa gaa tgg ttg cgc gag gtc ctt gcg	960
	Pro Val Ser Ala His Thr Ala Gln Glu Trp Leu Arg Glu Val Leu Ala	
	305 310 315 320	
65	cac cac ctg gtg tag	975
	His His Leu Val *	
	<210> 66	
	<211> 324	
	<212> PRT	

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<213> Bordetella pertussis

<400> 66

5 Met Arg Phe Arg Ala Gly Tyr Ser Arg Tyr Gln Ala Arg Ser Gly His
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 Gly Asp Arg Pro Pro Ala Gln Ala Arg Val Gln Thr Val Leu Leu
 20 25 30
 His Gly Leu Ser Ala Leu Thr Ala Gln Val Ala Gln Arg Phe Glu Met
 35 40 45
 10 Ala Arg His Arg Met ala Gly Pro Gly Arg Thr Thr Gly His His His
 50 55 60
 Phe Gln Leu Glu Ala Gln Arg Met ala Asp Thr Leu Arg Ser Val Gln
 65 70 75 80
 15 Gly Glu Pro Arg Trp Pro Asp Gly Ser Glu Ala Cys Met Pro Ser Gly
 85 90 95
 Leu Ser Cys Arg His Gly Thr Glu Glu Pro Lys Ala Ser His Ser Ala
 100 105 110
 Tyr Ser Met Phe Pro Leu Arg Arg Thr Arg Tyr Thr Gln Gly Phe Glu
 115 120 125
 20 Thr Thr Ala His Arg Met Asn Phe Gln Ile Pro Pro Ala Leu Pro Ala
 130 135 140
 Leu Glu Leu Asp Val Phe Ala Arg Ala Ala Ser Gln Gly Glu Thr Leu
 145 150 155 160
 25 Tyr Val Thr Lys Ala Gly Glu Gln Phe Gln Val Ile Ala Ser Gly Thr
 165 170 175
 Thr Pro Ser Gly Arg Asn Val Ser Trp Val Ala Thr Asp Glu Asp Thr
 180 185 190
 Leu Val Met Phe Ser Ser Ala Leu Ala Leu Ala Tyr Gly Thr Gly Ile
 195 200 205
 30 Ala Arg Ala Val Ala Lys Glu Leu Asp Leu His Ala Val Pro Thr Thr
 210 215 220
 Ser Leu Ser Ala Arg Val Val Thr Arg Ala Val Asp Met ala Glu Thr
 225 230 235 240
 35 Ser Arg His Ala Leu Gln Gly Val Asp Phe Leu Thr Phe Leu Ser Trp
 245 250 255
 Ser Ala Arg Ala Asp Ala Ala Gly Phe Arg Gln Val Cys His Asp Thr
 260 265 270
 Gly Val Ser Pro Asp Gln Ile Ser Gly Thr Leu Arg Ala Thr Ile Asp
 275 280 285
 40 Glu Ser Met Gln Gln Arg Phe Ala Ser Ala Ala Gln Ser Gly Lys Ala
 290 295 300
 Pro Val Ser Ala His Thr Ala Gln Glu Trp Leu Arg Glu Val Leu Ala
 305 310 315 320
 45 His His Leu Val

<210> 67

<211> 1146

<212> DNA

<213> Bordetella pertussis

<220>

<221> CDS

<222> (1)...(1146)

<400> 67

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 Met Leu Ile Asn Ala Ala Glu His Pro Ala Ala Ser Leu Asp Ala Asp
 1 5 10 15

48

	tgg tac cgg cga gtg cgg gtg ccg cgg ccc atc tac gag gaa ctc gtc	96
	Trp Tyr Arg Arg Val Arg Val Pro Arg Pro Ile Tyr Glu Glu Leu Val	
	20 25 30	
5	ggc cag cga ggc tgg ctg cac cgg atc ggg ata gac gcc aag gca cag	144
	Gly Gln Arg Gly Trp Leu His Arg Ile Gly Ile Asp Ala Lys Ala Gln	
	35 40 45	
10	aac agc ccc tgc acg tcg gtt ccc gtg gcc atc gcc gcg cgc tgc ctg	192
	Asn Ser Pro Cys Thr Ser Val Pro Val Ala Ile Ala Ala Arg Cys Leu	
	50 55 60	
15	aac gtc gtg ctg gcg ctg gct ccc gcg cag atc gcc atg ttc gcc aac	240
	Asn Val Val Leu Ala Leu Ala Pro Ala Gln Ile Ala Met Phe Ala Asn	
	65 70 75 80	
20	agc ccg ctg gag gca ggg cgg gtg acc ggt ctc aag gaa aac cgc ctg	288
	Ser Pro Leu Glu Ala Gly Arg Val Thr Gly Leu Lys Glu Asn Arg Leu	
	85 90 95	
	acc ctg tgg ccg cgc atg ttc cga ggc gcg cgc tac ctg ggc gac gac	336
	Thr Leu Trp Pro Arg Met Phe Arg Gly Ala Arg Tyr Leu Gly Asp Asp	
	100 105 110	
25	ctg ctg cat cgc ctg cct gca agg ccg ttt cgc gat ctc ggc gat tat	384
	Leu Leu His Arg Leu Pro Ala Arg Pro Phe Arg Asp Leu Gly Asp Tyr	
	115 120 125	
30	ttc cgc tgg atg ttc ggc gga ttg acc gcc agc cgg gcg cta ccg ccg	432
	Phe Arg Trp Met Phe Gly Gly Leu Thr Ala Ser Arg Ala Leu Pro Pro	
	130 135 140	
35	ggc gac gct tgc gac tac aag aac gcc gat gtg gcc tgc ctg gtg gga	480
	Gly Asp Ala Cys Asp Tyr Lys Asn Ala Asp Val Ala Cys Leu Val Gly	
	145 150 155 160	
40	gcc cct tcg ctg gca gag ttc ctg tat gcg ggc gcg tgg tcc gcg cga	528
	Ala Pro Ser Leu Ala Glu Phe Leu Tyr Ala Gly Ala Trp Ser Ala Arg	
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	aac ctg aat gat ggc ggt tcc gtg cgt ctg gcc gcg cgc agc gaa cat	576
	Asn Leu Asn Asp Gly Gly Ser Val Arg Leu Ala Ala Arg Ser Glu His	
	180 185 190	
45	ttc gtc tat tcg cag ttc gcg cag ttc ctg gac gcg cgt tgg cgc tac	624
	Phe Val Tyr Ser Gln Phe Ala Gln Phe Leu Asp Ala Arg Trp Arg Tyr	
	195 200 205	
50	agg atg ccg att gtc ccc gcc ttg ccg gcg ctg ttg cga gcc tgg gac	672
	Arg Met Pro Ile Val Pro Ala Leu Pro Ala Leu Leu Arg Ala Trp Asp	
	210 215 220	
55	agg cag ggc ggc ctg gaa gcg ctg ttc gag cag gcc ggc gcg caa ggc	720
	Arg Gln Gly Gly Leu Glu Ala Leu Phe Glu Gln Ala Gly Ala Gln Gly	
	225 230 235 240	
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	Tyr Ile Glu Gly Arg Ala Pro Gly Ala Val Phe Ala Asp Ala Asp Leu	
	245 250 255	

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ctg agc tca gcc ggc gat gca gtc gcg gcc agt gcg ccg atg gcg gcg 816
 Leu Ser Ser Ala Gly Asp Ala Val Ala Ala Ser Ala Pro Met ala Ala
 260 265 270

5 tgc gcg ctg caa ttg ggg ctg ttg cgc aat ctg cac gac gcc gag gcc 864
 Ser Ala Leu Gln Leu Gly Leu Leu Arg Asn Leu His Asp Ala Glu Ala
 275 280 285

10 ctg gtg agg cga tgg ggc tgg ctg cgc ttg cgt gcg ttg cgc gat cgg 912
 Leu Val Arg Arg Trp Gly Trp Leu Arg Leu Arg Ala Leu Arg Asp Arg
 290 295 300

15 gcc atc gct ttg gcg ttg gac gat gcg cag gtg cgc tgc ctt tgc caa 960
 Ala Ile Ala Leu Ala Leu Asp Asp Ala Gln Val Arg Cys Leu Cys Gln
 305 310 315 320

20 cag gtc gtg gcg gta gcc gaa ggc ggg ctg gcc ggc gac gag cag caa 1008
 Gln Val Val Ala Val Ala Glu Gly Gly Leu Ala Gly Asp Glu Gln Gln
 325 330 335

tgg ctc gat tat gtg cgt tac gtg gtg gaa acc ggc gag acc gcc gcg 1056
 Trp Leu Asp Tyr Val Arg Tyr Val Val Glu Thr Gly Glu Thr Ala Ala
 340 345 350

25 gac cgc atg ctg cgc ttg tgg cgc cag gcg cgc ggc acg cct gag atg 1104
 Asp Arg Met Leu Arg Leu Trp Arg Gln Ala Arg Gly Thr Pro Glu Met
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 <213> Bordetella pertussis

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 Asn Ser Pro Cys Thr Ser Val Pro Val Ala Ile Ala Ala Arg Cys Leu
 50 55 60
 Asn Val Val Leu Ala Leu Ala Pro Ala Gln Ile Ala Met Phe Ala Asn
 65 70 75 80

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 Thr Leu Trp Pro Arg Met Phe Arg Gly Ala Arg Tyr Leu Gly Asp Asp
 100 105 110

55 Leu Leu His Arg Leu Pro Ala Arg Pro Phe Arg Asp Leu Gly Asp Tyr
 115 120 125
 Phe Arg Trp Met Phe Gly Gly Leu Thr Ala Ser Arg Ala Leu Pro Pro
 130 135 140

60 Gly Asp Ala Cys Asp Tyr Lys Asn Ala Asp Val Ala Cys Leu Val Gly
 145 150 155 160
 Ala Pro Ser Leu Ala Glu Phe Leu Tyr Ala Gly Ala Trp Ser Ala Arg

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	Arg	Met	Pro	Ile	Val	Pro	Ala	Leu	Pro	Ala	Leu	Leu	Arg	Ala	Trp	Asp	
		210					215					220					
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	Tyr	Ile	Glu	Gly	Arg	Ala	Pro	Gly	Ala	Val	Phe	Ala	Asp	Ala	Asp	Leu	
				245					250						255		
	Leu	Ser	Ser	Ala	Gly	Asp	Ala	Val	Ala	Ala	Ser	Ala	Pro	Met	ala	Ala	
			260						265					270			
15	Ser	Ala	Leu	Gln	Leu	Gly	Leu	Leu	Arg	Asn	Leu	His	Asp	Ala	Glu	Ala	
		275						280					285				
	Leu	Val	Arg	Arg	Trp	Gly	Trp	Leu	Arg	Leu	Arg	Ala	Leu	Arg	Asp	Arg	
		290					295					300					
	Ala	Ile	Ala	Leu	Ala	Leu	Asp	Asp	Ala	Gln	Val	Arg	Cys	Leu	Cys	Gln	
20		305				310					315					320	
	Gln	Val	Val	Ala	Val	Ala	Glu	Gly	Gly	Leu	Ala	Gly	Asp	Glu	Gln	Gln	
				325						330					335		
	Trp	Leu	Asp	Tyr	Val	Arg	Tyr	Val	Val	Glu	Thr	Gly	Glu	Thr	Ala	Ala	
			340					345						350			
25	Asp	Arg	Met	Leu	Arg	Leu	Trp	Arg	Gln	Ala	Arg	Gly	Thr	Pro	Glu	Met	
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	Met	Thr	Leu	Arg	Pro	Gly	Ile	Leu	Ala	Pro	Leu	Ala	Leu	Leu	Leu	Gly	
	1				5					10					15		
45	ctc	gcg	tgg	ccc	atc	gcg	gcg	gca	tcc	agc	cct	cct	cct	gtc	gcg	ggc	96
	Leu	Ala	Trp	Pro	Ile	Ala	Ala	Ala	Ser	Ser	Pro	Pro	Pro	Val	Ala	Ala	
				20					25					30			
50	ctg	agc	tcc	ggc	gtc	gcc	ctt	acc	tgc	ccc	cgc	ctt	ccg	cct	ccc	tcc	144
	Leu	Ser	Ser	Gly	Val	Ala	Leu	Thr	Ser	Pro	Arg	Leu	Pro	Pro	Pro	Ser	
			35					40					45				
55	cat	aca	tcc	ggc	cgg	aaa	tgg	cgc	atc	ggc	tat	gtg	ggc	agc	ggc	gag	192
	His	Thr	Ser	Gly	Arg	Lys	Trp	Arg	Ile	Gly	Tyr	Val	Gly	Ser	Gly	Glu	
		50					55					60					
60	tac	gag	gag	tat	ccg	cgc	acg	ctc	tac	gcg	atc	gcg	cgc	gca	ttg	caa	240
	Tyr	Glu	Glu	Tyr	Pro	Arg	Thr	Leu	Tyr	Ala	Ile	Ala	Arg	Ala	Leu	Gln	
		65				70				75						80	
	caa	ctc	gga	tgg	ctg	cgt	atc	gac	gac	atg	ccc	gag	ata	acc	gat	atg	288
	Gln	Leu	Gly	Trp	Leu	Arg	Ile	Asp	Asp	Met	Pro	Glu	Ile	Thr	Asp	Met	

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	85	90	95	
5	cga aag gcc tgg ctt tac ctg gcc acg cat gcc cgc agc aac tac atc Arg Lys Ala Trp Leu Tyr Leu Ala Thr His Ala Arg Ser Asn Tyr Ile 100 105 110	336		
10	gag ttc gtg ccc gat gcg tgg tgg cag ccc ggc aac ttc gac acc gcc Glu Phe Val Pro Asp Ala Trp Trp Gln Pro Gly Asn Phe Asp Thr Ala 115 120 125	384		
15	ttg cgg cct gcc gtg cgc gaa gcc gtt gcg gca cgc ctg cat ggc gcc Leu Arg Pro Ala Val Arg Glu Ala Val Ala Ala Leu His Gly Ala 130 135 140	432		
20	aag gac atc gac ctg atc atc gcc atg ggt acc tgg gct gga cag gac Lys Asp Ile Asp Leu Ile Ile Ala Met Gly Thr Trp Ala Gly Gln Asp 145 150 155 160	480		
25	atg gtc gaa ctg ggc acg ccg gta ccc acc gtg gtc gtc tcg tcg acc Met Val Glu Leu Gly Thr Pro Val Pro Thr Val Val Val Ser Ser Thr 165 170 175	528		
30	gac ccg ata agc gcc cgg atc ata ccc agt gcg gcc gac agc ggc cag Asp Pro Ile Ser Ala Arg Ile Ile Pro Ser Ala Ala Asp Ser Gly Gln 180 185 190	576		
35	gac aac ctg cat gcc cgg gta cag ccc gac cac tac cag cgg cag atc Asp Asn Leu His Ala Arg Val Gln Pro Asp His Tyr Gln Arg Gln Ile 195 200 205	624		
40	cag ctg ctc cat gac atc gtg ccg ttc aag acg ctt gga ctg gtc tac Gln Leu Leu His Asp Ile Val Pro Phe Lys Thr Leu Gly Leu Val Tyr 210 215 220	672		
45	gaa gac acc gaa gca ggt cgc acc tac gca gcc atc gat aag gtc gcc Glu Asp Thr Glu Ala Gly Arg Thr Tyr Ala Ala Ile Asp Lys Val Ala 225 230 235 240	720		
50	gca cta atg ccg gca ttg gat ttc tcc gtc aag cgt tgc gac gca cgc Ala Leu Met Pro Ala Leu Asp Phe Ser Val Lys Arg Cys Asp Ala Arg 245 250 255	768		
55	gcg acc ggc atc ccc atc gcc acg gca acc cag aac gtt ctg gct tgc Ala Thr Gly Ile Pro Ile Ala Thr Ala Thr Gln Asn Val Leu Ala Cys 260 265 270	816		
60	tac cag aag ctg tcg agc gaa gtc gac gcc ttt tac gtc acc gag cac Tyr Gln Lys Leu Ser Ser Glu Val Asp Ala Phe Tyr Val Thr Glu His 275 280 285	864		
65	cgg ggc atc acc tcg acg tcc gtc aag cag ctc gcc gcg ctg ctg cgc Arg Gly Ile Thr Ser Thr Ser Val Lys Gln Leu Ala Ala Leu Leu Arg 290 295 300	912		
70	gcc gcc cgc gtg ccg agt ttc tcg atg caa ggc tcc gac gag gtc aag Ala Ala Arg Val Pro Ser Phe Ser Met Gln Gly Ser Asp Glu Val Lys 305 310 315 320	960		
75	gcc ggc ctg ttg atg agc ctg gcc aag gcg gac tac tcc agc gta ggc Ala Gly Leu Leu Met Ser Leu Ala Lys Ala Asp Tyr Ser Ser Val Gly 1008			

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		325		330		335	
5	atg ttc cac gcc cag acc att gcc cgc att ttc aat ggg gaa aag ccg						1056
	Met Phe His Ala Gln Thr Ile Ala Arg Ile Phe Asn Gly Glu Lys Pro	340		345		350	
10	cgc agc atc agc cag gtc tgg aat gcc ccc gcc aag ata gcc atc aat						1104
	Arg Ser Ile Ser Gln Val Trp Asn Ala Pro Ala Lys Ile Ala Ile Asn	355		360		365	
15	ctg gaa acg gcg cgg cgc atc gcc ttc gac cca ccg gtg gat att ctg						1152
	Leu Glu Thr Ala Arg Arg Ile Gly Phe Asp Pro Pro Val Asp Ile Leu	370		375		380	
20	ctg gcg gcc gac gag gtg tac gaa gcg gag cac tga cag gcc tgg cca						1200
	Leu Ala Ala Asp Glu Val Tyr Glu Ala Glu His * Gln Ala Trp Pro	385		390		395	
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	Thr Arg Pro Gly Lys Glu Cys Ala Gly Ser *	400		405			
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40	Leu Ser Ser Gly Val Ala Leu Thr Ser Pro Arg Leu Pro Pro Pro Ser	35		40		45	
	His Thr Ser Gly Arg Lys Trp Arg Ile Gly Tyr Val Gly Ser Gly Glu	50		55		60	
	Tyr Glu Glu Tyr Pro Arg Thr Leu Tyr Ala Ile Ala Arg Ala Leu Gln	65		70		75	80
45	Gln Leu Gly Trp Leu Arg Ile Asp Asp Met Pro Glu Ile Thr Asp Met	85		90		95	
	Arg Lys Ala Trp Leu Tyr Leu Ala Thr His Ala Arg Ser Asn Tyr Ile	100		105		110	
	Glu Phe Val Pro Asp Ala Trp Trp Gln Pro Gly Asn Phe Asp Thr Ala	115		120		125	
50	Leu Arg Pro Ala Val Arg Glu Ala Val Ala Ala Arg Leu His Gly Ala	130		135		140	
	Lys Asp Ile Asp Leu Ile Ile Ala Met Gly Thr Trp Ala Gly Gln Asp	145		150		155	160
	Met Val Glu Leu Gly Thr Pro Val Pro Thr Val Val Val Ser Ser Thr	165		170		175	
55	Asp Pro Ile Ser Ala Arg Ile Ile Pro Ser Ala Ala Asp Ser Gly Gln	180		185		190	
	Asp Asn Leu His Ala Arg Val Gln Pro Asp His Tyr Gln Arg Gln Ile	195		200		205	
	Gln Leu Leu His Asp Ile Val Pro Phe Lys Thr Leu Gly Leu Val Tyr	210		215		220	
60	Glu Asp Thr Glu Ala Gly Arg Thr Tyr Ala Ala Ile Asp Lys Val Ala	225		230		235	240
	Ala Leu Met Pro Ala Leu Asp Phe Ser Val Lys Arg Cys Asp Ala Arg						

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	cca ggc ctt tcg cat atc ggt tat ctc ggg cat gtc gtc gat acg cag	384
	Pro Gly Leu Ser His Ile Gly Tyr Leu Gly His Val Val Asp Thr Gln	
	115 120 125	
5	cca tcc gag ttg ttg caa tgc gcg cgc gat cgc gta gag cgt gcg cgg	432
	Pro Ser Glu Leu Leu Gln Cys Ala Arg Asp Arg Val Glu Arg Ala Arg	
	130 135 140	
10	ata ctc ctc gta ctc gcc gct acc cac ata acc gat gcg cca ttt ccg	480
	Ile Leu Leu Val Leu Ala Ala Thr His Ile Thr Asp Ala Pro Phe Pro	
	145 150 155 160	
15	gcc gga tgt atg gga ggg agg cgg aag gcg ggg cga ggt aag ggc gac	528
	Ala Gly Cys Met Gly Gly Arg Arg Lys Ala Gly Arg Gly Lys Gly Asp	
	165 170 175	
20	gcc gga gct cag gcc cgc gac agg agg agg gct gga tgc cgc cgc gat	576
	Ala Gly Ala Gln Gly Arg Asp Arg Arg Ala Gly Cys Arg Arg Asp	
	180 185 190	
25	ggg cca cgc gag gcc aag aag cag gcc gag cgg gcc gag tat tcc ggg	624
	Gly Pro Arg Glu Ala Lys Lys Gln Gly Glu Arg Gly Glu Tyr Ser Gly	
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	Ala Lys Gly His Gly Arg *	
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45	Ala Tyr Arg Val Gly Arg Arg Asp His Gly Gly Tyr Arg Arg Ala	
	35 40 45	
	Gln Phe Asp His Val Leu Ser Ser Pro Gly Thr His Gly Asp Asp Gln	
	50 55 60	
50	Val Asp Val Leu Gly Ala Met Gln Ala Cys Arg Asn Gly Phe Ala His	
	65 70 75 80	
	Gly Arg Pro Gln Gly Gly Val Glu Val Ala Gly Leu Pro Pro Arg Ile	
	85 90 95	
	Gly His Glu Leu Asp Val Val Ala Ala Gly Met Arg Gly Gln Val Lys	
	100 105 110	
55	Pro Gly Leu Ser His Ile Gly Tyr Leu Gly His Val Val Asp Thr Gln	
	115 120 125	
	Pro Ser Glu Leu Leu Gln Cys Ala Arg Asp Arg Val Glu Arg Ala Arg	
	130 135 140	
60	Ile Leu Leu Val Leu Ala Ala Thr His Ile Thr Asp Ala Pro Phe Pro	
	145 150 155 160	
	Ala Gly Cys Met Gly Gly Arg Arg Lys Ala Gly Arg Gly Lys Gly Asp	
	165 170 175	
	Ala Gly Ala Gln Gly Arg Asp Arg Arg Ala Gly Cys Arg Arg Asp	
	180 185 190	
	Gly Pro Arg Glu Ala Lys Lys Gln Gly Glu Arg Gly Glu Tyr Ser Gly	

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	1 5 10 15			
20	ccg ggc gcg gtc atc gcg ccc gac gaa cgc ctg tcc tgg ccc aag aac			96
	Pro Gly Ala Val Ile Ala Pro Asp Glu Arg Leu Ser Trp Pro Lys Asn			
	20 25 30			
25	atc gcc atg ggg gcc cag cac gtg gtc gcc atg ttc ggt tcc acc gtg			144
	Ile Ala Met Gly Ala Gln His Val Val Ala Met Phe Gly Ser Thr Val			
	35 40 45			
30	ctg gcg ccg ctg ctg atg ggt ttc gac ccc aat gtg gcg atc ctc atg			192
	Leu Ala Pro Leu Leu Met Gly Phe Asp Pro Asn Val Ala Ile Leu Met			
	50 55 60			
35	tcc ggc atc ggc acg ctg atc ttc ttc ctg ttc gtc ggc ggc cgg gtg			240
	Ser Gly Ile Gly Thr Leu Ile Phe Phe Leu Phe Val Gly Gly Arg Val			
	65 70 75 80			
40	ccc agc tac ctg ggc tcc agc ttc gcc ttc atc ggc ggg gtg gtg gcg			288
	Pro Ser Tyr Leu Gly Ser Ser Phe Ala Phe Ile Gly Gly Val Val Ala			
	85 90 95			
45	gtc acc ggc tat gtg gcg ccc ggc gcc aac gcc aat atc ggc gtg gcg			336
	Val Thr Gly Tyr Val Ala Pro Gly Ala Asn Ala Asn Ile Gly Val Ala			
	100 105 110			
50	ctc ggc gcg atc atc gcc tgt ggc ctg gtg tac gcg ctg atc ggc ctg			384
	Leu Gly Ala Ile Ile Ala Cys Gly Leu Val Tyr Ala Leu Ile Gly Leu			
	115 120 125			
55	gtc gta tgg gcg gcc agc gcg cgc ggc aac ggg gcg cgc tgg atc gag			432
	Val Val Trp Ala Ala Ser Ala Arg Gly Asn Gly Ala Arg Trp Ile Glu			
	130 135 140			
60	gcc atg atg ccg ccg gtc gtc acg ggc gcg gtg gtg gcg gtg atc ggc			480
	Ala Met Met Pro Pro Val Val Thr Gly Ala Val Val Ala Val Ile Gly			
	145 150 155 160			
65	ctg aac ctg gcc ccg atc gcc gcc aag ggc gcc atg ggt tcc ggc			528
	Leu Asn Leu Ala Pro Ile Ala Ala Lys Gly Ala Met Gly Ser Ser Gly			
	165 170 175			
70	ttc gag gcc agc atg gcg ttg atg acc atc ctg tgc gtg ggc ggc atc			576
	Phe Glu Ala Ser Met ala Leu Met Thr Ile Leu Cys Val Gly Gly Ile			

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15	ctg ggc gcg ccc atg gac ttc gcc aag gtg gcc gcc gcg ccg tgg ttc Leu Gly Ala Pro Met Asp Phe Ala Lys Val Ala Ala Ala Pro Trp Phe 225 230 235 240	720		
20	ggc ctg ccc agc ttc gcc gcg ccg gtg ttc gag ccg cag gcc atg ggc Gly Leu Pro Ser Phe Ala Ala Pro Val Phe Glu Pro Gln Ala Met Gly 245 250 255	768		
25	ctg atc gtg ccg gtg gcc atc atc ctg gtg gcc gag aac ctg ggc cac Leu Ile Val Pro Val Ala Ile Ile Leu Val Ala Glu Asn Leu Gly His 260 265 270	816		
30	gtg aag gcg gtc gcc gcc atg acc gga cag gac ctg gac cgc tac gtg Val Lys Ala Val Ala Ala Met Thr Gly Gln Asp Leu Asp Arg Tyr Val 275 280 285	864		
35	ggc cgc gcc ttc gtg gcc gac gcc gtg gcg acc atg gtt tcc ggc gcc Gly Arg Ala Phe Val Gly Asp Gly Val Ala Thr Met Val Ser Gly Ala 290 295 300	912		
40	gtc ggc ggc acc ggg gtg acc acc tac gcc gag aat atc ggc gtg atg Val Gly Gly Thr Gly Val Thr Thr Tyr Ala Glu Asn Ile Gly Val Met 305 310 315 320	960		
45	gcc gtg acg cgc atc tat tcc acg ctg gtg ttc gtg gtg gcg gcc gtg Ala Val Thr Arg Ile Tyr Ser Thr Leu Val Phe Val Val Ala Val 325 330 335	1008		
50	atc gcg ctg gtg ctg ggg ttc tcg ccc aag ttc ggc gcg ctg atc cag Ile Ala Leu Val Leu Gly Phe Ser Pro Lys Phe Gly Ala Leu Ile Gln 340 345 350	1056		
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60	ctg atc gcc atc gcc ggc gcg cgc atc tgg gtg gtc aac cag gtc gat Leu Ile Ala Ile Ala Gly Ala Arg Ile Trp Val Val Asn Gln Val Asp 370 375 380	1152		
65	ttc agc gac aac cgc aat ctg atc gtg gcc gcc gtg acc ctg gtg ctg Phe Ser Asp Asn Arg Asn Leu Ile Val Ala Ala Val Thr Leu Val Leu 385 390 395 400	1200		
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75	atc ggc acc gcc acg ttc ggc gcc atc atc ctg tac gcc ctg ctg ggc Ile Gly Thr Ala Thr Phe Gly Ala Ile Ile Leu Tyr Ala Leu Leu Gly 420 425 430 435 440	1296		

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420 425 430

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 Leu Ala Arg Arg Arg *

5 435

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 35 40 45
 20 Leu Ala Pro Leu Leu Met Gly Phe Asp Pro Asn Val Ala Ile Leu Met
 50 55 60
 Ser Gly Ile Gly Thr Leu Ile Phe Phe Leu Phe Val Gly Gly Arg Val
 65 70 75 80
 25 Pro Ser Tyr Leu Gly Ser Ser Phe Ala Phe Ile Gly Gly Val Val Ala
 85 90 95
 Val Thr Gly Tyr Val Ala Pro Gly Ala Asn Ala Asn Ile Gly Val Ala
 100 105 110
 Leu Gly Ala Ile Ile Ala Cys Gly Leu Val Tyr Ala Leu Ile Gly Leu
 115 120 125
 30 Val Val Trp Ala Ala Ser Ala Arg Gly Asn Gly Ala Arg Trp Ile Glu
 130 135 140
 Ala Met Met Pro Pro Val Val Thr Gly Ala Val Val Ala Val Ile Gly
 145 150 155 160
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 165 170 175
 Phe Glu Ala Ser Met ala Leu Met Thr Ile Leu Cys Val Gly Gly Ile
 180 185 190
 Ala Val Tyr Thr Arg Gly Met Val Gln Arg Leu Leu Ile Leu Val Gly
 195 200 205
 40 Leu Val Leu Ala Cys Val Ile Tyr Ala Val Cys Ala Asn Gly Leu Gly
 210 215 220
 Leu Gly Ala Pro Met Asp Phe Ala Lys Val Ala Ala Pro Trp Phe
 225 230 235 240
 45 Gly Leu Pro Ser Phe Ala Ala Pro Val Phe Glu Pro Gln Ala Met Gly
 245 250 255
 Leu Ile Val Pro Val Ala Ile Ile Leu Val Ala Glu Asn Leu Gly His
 260 265 270
 Val Lys Ala Val Ala Ala Met Thr Gly Gln Asp Leu Asp Arg Tyr Val
 275 280 285
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 Val Gly Gly Thr Gly Val Thr Thr Tyr Ala Glu Asn Ile Gly Val Met
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 55 Ala Val Thr Arg Ile Tyr Ser Thr Leu Val Phe Val Val Ala Ala Val
 325 330 335
 Ile Ala Leu Val Leu Gly Phe Ser Pro Lys Phe Gly Ala Leu Ile Gln
 340 345 350
 Thr Ile Pro Gly Pro Val Leu Gly Gly Met Ser Val Val Val Phe Gly
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370
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 Gly Ala Gly Asp Phe Ser Val Lys Leu Gly Asp Phe Ser Met Asn Gly
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 tgc ttc ctg gcg gtg ctg atg ctg tcg ggc gcc ctg acg tgg cgc aac
 Cys Phe Leu Ala Val Leu Met Leu Ser Gly Ala Leu Thr Trp Arg Asn
 20 25 30
 gcg ggc agg agc gcc gcc gag atc gag ggg ctg aac cag gtc gcc gtc
 Ala Gly Arg Ser Ala Ala Glu Ile Glu Gly Leu Asn Gln Val Ala Val
 35 40 45
 aac cag gtc gac ccg ctg ttc gag gcc agc ggc gcg gcg cag cgc cag
 Asn Gln Val Asp Pro Leu Phe Glu Ala Ser Gly Ala Ala Gln Arg Gln
 50 55 60
 gcg gcc acg caa ttc cag cgc tac gtg gac gtg ccc aag gag ccg gcc
 Ala Ala Thr Gln Phe Gln Arg Tyr Val Asp Val Pro Lys Glu Pro Ala
 65 70 75 80
 gcg gcc gag ctg gcc gcg acc ctg cag acg cgc tgg cgc gcc tac cag
 Ala Ala Glu Leu Ala Ala Thr Leu Gln Thr Arg Trp Arg Ala Tyr Gln
 85 90 95
 tcg gtg ctg gac gag ctg gcc gcc gcc gtc gac gcc ggc cag gcc gag
 Ser Val Leu Asp Glu Leu Ala Ala Val Asp Ala Gly Gln Ala Glu
 100 105 110
 ccc gcc ctg gcc gcc atg cat cgc gcg cag cag gcc gaa cat gca ttc
 Pro Ala Leu Ala Ala Met His Arg Ala Gln Gln Ala Glu His Ala Phe
 115 120 125
 cag cgc gac atg gaa gcc ttt ctg gcc agg gta cag gcg cac agc gac
 Gln Arg Asp Met Glu Ala Phe Leu Ala Arg Val Gln Ala His Ser Asp
 130 135 140
 gaa gtg cgc agc ggc gcc gag gac acc cat gtc gtg gcc cgc tgg agc
 Glu Val Arg Ser Gly Ala Glu Asp Thr His Val Val Ala Arg Trp Ser
 145 150 155 160

48
 96
 144
 192
 240
 288
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 384
 432
 480

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	gcc atc gcg ctg acc acg ctg ggc gtg ctg ctg acc ctg gcc ggc tgg	528
	Ala Ile Ala Leu Thr Thr Leu Gly Val Leu Leu Thr Leu Ala Gly Trp	
	165 170 175	
5	ctg ttc gtg cgc cgc gcg gtg ctg cgc ccc ttg ctg gag gcc ggc cat	576
	Leu Phe Val Arg Arg Ala Val Leu Arg Pro Leu Leu Glu Ala Gly His	
	180 185 190	
10	cat ttc gac cgc atc gcc gac ggc gac ctc acc gcg cgc atc gag gtg	624
	His Phe Asp Arg Ile Ala Asp Gly Asp Leu Thr Ala Arg Ile Glu Val	
	195 200 205	
15	cgc tcg gcc aat gaa atc ggc gcg ctg ttc gcg gcg ctc aag cgc atg	672
	Arg Ser Ala Asn Glu Ile Gly Ala Leu Phe Ala Ala Leu Lys Arg Met	
	210 215 220	
20	cag gaa ggc ctg acg cgc acc atc gcc gtc atg cgg cgc ggc gtc gac	720
	Gln Glu Gly Leu Thr Arg Thr Ile Ala Val Met Arg Arg Gly Val Asp	
	225 230 235 240	
	gaa atc aac gtc ggc gcg gcc gag atc tcg gcc ggc aac gcc aac ctg	768
	Glu Ile Asn Val Gly Ala Ala Glu Ile Ser Ala Gly Asn Ala Asn Leu	
	245 250 255	
25	tcc agc cgc acg gag gag cag gcc gcc gcc ctg gaa gag acc gcg gcc	816
	Ser Ser Arg Thr Glu Glu Gln Ala Ala Ala Leu Glu Glu Thr Ala Ala	
	260 265 270	
30	acc atg gag gaa ctg gcc acc acg gtc aag cag aac gcc gac aat gcc	864
	Thr Met Glu Glu Leu Ala Thr Thr Val Lys Gln Asn Ala Asp Asn Ala	
	275 280 285	
35	gcg cag gcc aat cag ctg gcc gcc gtc agc atg cag gtg gcg cag cgc	912
	Ala Gln Ala Asn Gln Leu Ala Ala Val Ser Met Gln Val Ala Gln Arg	
	290 295 300	
40	ggc ggc gag tcg gtc gcg cag gtg gtg cag acc atg cac ggc atc tcc	960
	Gly Gly Glu Ser Val Ala Gln Val Val Gln Thr Met His Gly Ile Ser	
	305 310 315 320	
	gcg agc tcg cgc cag atc gcc gac atc gtc acc gtg atc gac ggc atc	1008
	Ala Ser Ser Arg Gln Ile Ala Asp Ile Val Thr Val Ile Asp Gly Ile	
	325 330 335	
45	gcc ttc cag acc aat atc ctg gcg ctg aac gcc gcg gtc gag gcg gcg	1056
	Ala Phe Gln Thr Asn Ile Leu Ala Leu Asn Ala Ala Val Glu Ala Ala	
	340 345 350	
50	cgc gcc ggc gaa cag ggc aag ggc ttc gcg gtg gtg gcg ggc gag gtg	1104
	Arg Ala Gly Glu Gln Gly Lys Gly Phe Ala Val Val Ala Gly Glu Val	
	355 360 365	
55	cgc agc ctg gcc cag cgc gcc gcg cag gcg gcc aag gag atc aag gcc	1152
	Arg Ser Leu Ala Gln Arg Ala Ala Gln Ala Ala Lys Glu Ile Lys Ala	
	370 375 380	
60	ctg atc gag agc tcg gtg gcg acg gtg cgc gcc ggc tcg caa cag gtc	1200
	Leu Ile Glu Ser Ser Val Ala Thr Val Arg Ala Gly Ser Gln Gln Val	
	385 390 395 400	

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	gcc agc gcc ggc ggc acc atg gac gag gtg gtg gcc tcg gta cag cgc	1248
	Ala Ser Ala Gly Gly Thr Met Asp Glu Val Val Ala Ser Val Gln Arg	
	405 410 415	
5	gtg gcc gac atc atg ggg gag atc tcg gcc gcc tcg gcc cag cag gcc	1296
	Val Ala Asp Ile Met Gly Glu Ile Ser Ala Ala Ser Ala Gln Gln Ala	
	420 425 430	
10	agc ggc atc gac cag gtc agc ctg gcg att tcg caa atg gac gaa acc	1344
	Ser Gly Ile Asp Gln Val Ser Leu Ala Ile Ser Gln Met Asp Glu Thr	
	435 440 445	
15	acc cag cag aat gcc gcg ctg gtc gaa cag gcc gcg gcg gcg gcc acg	1392
	Thr Gln Gln Asn Ala Ala Leu Val Glu Gln Ala Ala Ala Ala Thr	
	450 455 460	
20	gcc atg gaa gaa cag gcc cgc cac ctg gcg gcc gcg gcg gcg gtc ttc	1440
	Ala Met Glu Glu Gln Ala Arg His Leu Ala Ala Ala Ala Val Phe	
	465 470 475 480	
	agg acg cag ggc ggc gcc atc atc gac gtc gcc gcc gcg ccg ctg gcc	1488
	Arg Thr Gln Gly Gly Ala Ile Ile Asp Val Ala Ala Ala Pro Leu Ala	
	485 490 495	
25	ggg ccg gcg ggc ggc cat gcc gcc ctg ccg ccg gcc gcg gcc cac tga	1536
	Gly Pro Ala Gly Gly His Ala Ala Leu Pro Pro Ala Ala Ala His *	
	500 505 510	
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	<211> 511	
	<212> PRT	
	<213> Bordetella pertussis	
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	Cys Phe Leu Ala Val Leu Met Leu Ser Gly Ala Leu Thr Trp Arg Asn	
	20 25 30	
40	Ala Gly Arg Ser Ala Ala Glu Ile Glu Gly Leu Asn Gln Val Ala Val	
	35 40 45	
	Asn Gln Val Asp Pro Leu Phe Glu Ala Ser Gly Ala Ala Gln Arg Gln	
	50 55 60	
45	Ala Ala Thr Gln Phe Gln Arg Tyr Val Asp Val Pro Lys Glu Pro Ala	
	65 70 75 80	
	Ala Ala Glu Leu Ala Ala Thr Leu Gln Thr Arg Trp Arg Ala Tyr Gln	
	85 90 95	
	Ser Val Leu Asp Glu Leu Ala Ala Val Asp Ala Gly Gln Ala Glu	
	100 105 110	
50	Pro Ala Leu Ala Ala Met His Arg Ala Gln Gln Ala Glu His Ala Phe	
	115 120 125	
	Gln Arg Asp Met Glu Ala Phe Leu Ala Arg Val Gln Ala His Ser Asp	
	130 135 140	
55	Glu Val Arg Ser Gly Ala Glu Asp Thr His Val Val Ala Arg Trp Ser	
	145 150 155 160	
	Ala Ile Ala Leu Thr Thr Leu Gly Val Leu Leu Thr Leu Ala Gly Trp	
	165 170 175	
	Leu Phe Val Arg Arg Ala Val Leu Arg Pro Leu Leu Glu Ala Gly His	
	180 185 190	
60	His Phe Asp Arg Ile Ala Asp Gly Asp Leu Thr Ala Arg Ile Glu Val	

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	35	40	45	
5	gac gcc gcc cgc gaa cgc cag ggc ttc atc gaa ggc cgg atc tcc gaa Asp Ala Ala Arg Glu Arg Gln Gly Phe Ile Glu Gly Arg Ile Ser Glu 50 55 60	192		
10	ctc gag ggc acg ctt tcg aac gcg cac ctc atc gat cca acg gcg ctc Leu Glu Gly Thr Leu Ser Asn Ala His Leu Ile Asp Pro Thr Ala Leu 65 70 75 80	240		
15	gac gcc gaa ggc cgt gcc gtg ttc ggc gcg acc gtg gaa atc gaa gac Asp Ala Glu Gly Arg Ala Val Phe Gly Ala Thr Val Glu Ile Glu Asp 85 90 95	288		
20	ctc gac tcg ggc gac cgc ctg acc tac cag atc gtg ggc gac gtc gaa Leu Asp Ser Gly Asp Arg Leu Thr Tyr Gln Ile Val Gly Asp Val Glu 100 105 110	336		
25	gcc gac atc aag tcc aac ctg att tcg gtc tcc agc ccg gtg gcc cgc Ala Asp Ile Lys Ser Asn Leu Ile Ser Val Ser Ser Pro Val Ala Arg 115 120 125	384		
30	gcc ctg atc ggc aaa tcc gag ggc gat gtg gtc gaa gtg aag gtg ccg Ala Leu Ile Gly Lys Ser Glu Gly Asp Val Val Glu Val Lys Val Pro 130 135 140	432		
35	gct ggc gtg cgc gag tac gaa gtc atc ggt gtg cgt tat ctc tga Ala Gly Val Arg Glu Tyr Glu Val Ile Gly Val Arg Tyr Leu * 145 150 155	477		
	<210> 78 <211> 158 <212> PRT <213> Bordetella pertussis			
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	1 5 10 15	
15	atg gtc cag caa ttg atc gcc cat caa gtt tgt gtg cct gaa gcg gcc Met Val Gln Gln Leu Ile Ala His Gln Val Cys Val Pro Glu Ala Ala	96
	20 25 30	
20	cgc gcc tat ggg gtc acc gcg ccg act gtg cgc aaa tgg ctg ggc cgc Arg Ala Tyr Gly Val Thr Ala Pro Thr Val Arg Lys Trp Leu Gly Arg	144
	35 40 45	
25	ttc ctg gct cag ggc cag gcg gcc ttg gcc gat gcg tcc tcg cgc ccg Phe Leu Ala Gln Gly Gln Ala Gly Leu Ala Asp Ala Ser Ser Arg Pro	192
	50 55 60	
30	acg gtc tcg ccc cga gcg att gcg ccg gcc aag gcg ctg gct atc gtg Thr Val Ser Pro Arg Ala Ile Ala Pro Ala Lys Ala Leu Ala Ile Val	240
	65 70 75 80	
35	gag ctg cgc cgc aag cgg ctg acc caa gcg cgc atc gcc cag gcg ctg Glu Leu Arg Arg Lys Arg Leu Thr Gln Ala Arg Ile Ala Gln Ala Leu	288
	85 90 95	
40	ggc gtg tca gcc agc acc gtc agc cgc gtc ctg gcc cgc gcc ggt ctg Gly Val Ser Ala Ser Thr Val Ser Arg Val Leu Ala Arg Ala Gly Leu	336
	100 105 110	
45	tcg cac ctg gcc gac ctg gag ccg gcc gag ccg gtg gtg cgc tac gag Ser His Leu Ala Asp Leu Glu Pro Ala Glu Pro Val Val Arg Tyr Glu	384
	115 120 125	
50	cat cag gcc ccc ggc gat ctg ctg cac atc gac atc aag aag ctg gga His Gln Ala Pro Gly Asp Leu Leu His Ile Asp Ile Lys Lys Leu Gly	432
	130 135 140	
55	cgt atc cag cgc cct ggc cac cgg gtc acg ggc aac cga cgc gat acc Arg Ile Gln Arg Pro Gly His Arg Val Thr Gly Asn Arg Arg Asp Thr	480
	145 150 155 160	
60	gtt gag ggg gcc ggc tgg gac ttc gtc ttc gtg gcc atc gat gac cac Val Glu Gly Ala Gly Trp Asp Phe Val Phe Val Ala Ile Asp Asp His	528
	165 170 175	
65	gcc cgc gtg gcc ttc acc gac atc cac ccc gac gag cgc ttc ccc agc Ala Arg Val Ala Phe Thr Asp Ile His Pro Asp Glu Arg Phe Pro Ser	576
	180 185 190	
70	gcc gtc cag ttc ctc aag gac gca gtg gcc tac tac cag cgc ctg ggc Ala Val Gln Phe Leu Lys Asp Ala Val Ala Tyr Tyr Gln Arg Leu Gly	624
	195 200 205	

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	gtg acc atc cag cgc ttg ctc acc gac aat ggc tcg gcc ttt cgc agc	672
	Val Thr Ile Gln Arg Leu Leu Thr Asp Asn Gly Ser Ala Phe Arg Ser	
	210 215 220	
5	cgc gcc ttc gcc gcg ctg tgc cat gag ctg ggc atc aag cac cgc ttt	720
	Arg Ala Phe Ala Ala Leu Cys His Glu Leu Gly Ile Lys His Arg Phe	
	225 230 235 240	
10	acc cga cct tac cgc cca cag acc aat ggc aag gcc gaa cgc ttc atc	768
	Thr Arg Pro Tyr Arg Pro Gln Thr Asn Gly Lys Ala Glu Arg Phe Ile	
	245 250 255	
15	cag tcg gcc ttg cgt gag tgg gct tac gct cac acc tac cag aac tcc	816
	Gln Ser Ala Leu Arg Glu Trp Ala Tyr Ala His Thr Tyr Gln Asn Ser	
	260 265 270	
20	caa cac cga gcc gat gcc atg aaa tcc tgg cta cac cac tac aac tgg	864
	Gln His Arg Ala Asp Ala Met Lys Ser Trp Leu His His Tyr Asn Trp	
	275 280 285	
	cat cga ccc cac caa ggc atc ggg cgc gct gta ccc atc tcc aga ctc	912
	His Arg Pro His Gln Gly Ile Gly Arg Ala Val Pro Ile Ser Arg Leu	
	290 295 300	
25	aac ctg gac gaa tac aac cta ttg aca gtt cac acc tag	951
	Asn Leu Asp Glu Tyr Asn Leu Leu Thr Val His Thr *	
	305 310 315	
30	<210> 80 <211> 316 <212> PRT <213> Bordetella pertussis	
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40		
45		
50		
55		
60		

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	130	135	140	
5	tac ttc ccc gcg tgg aag tgg gtt ctc gcc atc tcc gat agc tca caa Tyr Phe Pro Ala Trp Lys Trp Val Leu Ala Ile Ser Asp Ser Ser Gln 145 150 155 160	480		
10	gcc atc atc gac aag gtt gcc gcc cag aaa gcc aac atg att gcc gcg Ala Ile Ile Asp Lys Val Ala Ala Gln Lys Ala Asn Met Ile Ala Ala 165 170 175	528		
15	ata gac cgg aac ctg tcg gag ctg cgg ctc agc cgc cat ggt ttc gtg Ile Asp Arg Asn Leu Ser Glu Leu Arg Leu Ser Arg His Gly Phe Val 180 185 190	576		
20	ttc gtg gtt gcg gac gat ggc acg gtg atc gtg ccg cca ccc cca tcg Phe Val Val Ala Asp Asp Gly Thr Val Ile Val Pro Pro Pro Ser 195 200 205	624		
25	gcc gcc cgg ctg ctg gac tcg aca gac gtc gaa tcg gga cgg gta ttg Ala Ala Arg Leu Leu Asp Ser Thr Asp Val Glu Ser Gly Arg Val Leu 210 215 220	672		
30	cat tcg atg ctt gcc gaa atc tcg tct acc cgc ggc ctg acg ttg cgc His Ser Met Leu Ala Glu Ile Ser Ser Thr Arg Gly Leu Thr Leu Arg 225 230 235 240	720		
35	ttt acc aac ggc gaa agc gcc tgg cag atc gac gcc ctg cga tac aag Phe Thr Asn Gly Glu Ser Ala Trp Gln Ile Asp Ala Leu Arg Tyr Lys 245 250 255	768		
40	ccg ctg cat tgg acc atc atc ggt gtc gtt ccc gag ccg gac ctg acc Pro Leu His Trp Thr Ile Ile Gly Val Val Pro Glu Pro Asp Leu Thr 260 265 270	816		
45	gac ccg gca cag aat ctg gtg cgc ccg cag gca ctg atc ttc gcc gcc Asp Pro Ala Gln Asn Leu Val Arg Arg Gln Ala Leu Ile Phe Ala Ala 275 280 285	864		
50	acc ttg ctg gcc ggg ctg atg ctg gca tgg gtg gtg gcc gtg cgc atc Thr Leu Leu Ala Gly Leu Met Leu Ala Trp Val Val Ala Val Arg Ile 290 295 300	912		
55	gcc cgg ccg ttg gcg caa ctg agc aac tac gct cgc cag ctt ccc acc Ala Arg Pro Leu Ala Gln Leu Ser Asn Tyr Ala Arg Gln Leu Pro Thr 305 310 315 320	960		
60	cag gac ctc acc gag ccg atc cgg gtt ccg ccg tcg gtg gca tgc ctg Gln Asp Leu Thr Glu Pro Ile Arg Val Pro Pro Ser Val Ala Cys Leu 325 330 335	1008		
65	ccg cgc cgg cgg cgc gac gaa gtc gga cag ctc gcc gaa tcg ttc ctg Pro Arg Arg Arg Arg Asp Glu Val Gly Gln Leu Ala Glu Ser Phe Leu 340 345 350	1056		
70	ttc atg aac gaa cag ctg cac cac aat gtg ccg gcc ctg atg gcg cag Phe Met Asn Glu Gln Leu His His Asn Val Arg Ala Leu Met ala Gln 355 360 365	1104		
75	ata tcg aac cgc gaa cgc ctc gaa agc gaa ttg agc atc gcc cgc tcc Ile Ser Asn Arg Glu Arg Leu Glu Ser Glu Leu Ser Ile Ala Arg Ser 370 375 380	1152		

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	370	375	380	
5	atc caa ctt ggc ctg ctt ccc cag ccg ttg ccc gat gcg gcc acg cgc Ile Gln Leu Gly Leu Leu Pro Gln Pro Leu Pro Asp Ala Ala Thr Arg 385 390 395 400			1200
10	ggc agc cag ttg cgt gcc gtc atg tac ccg gcc cgg gag gtc ggt ggg Gly Ser Gln Leu Arg Ala Val Met Tyr 410 Ala Arg Glu Val Gly Gly 405 415			1248
15	gat ttc tac gac tac ttc gtg ctg gca gac ggg cgt ctg tgc ttt gcc Asp Phe Tyr Asp Tyr Phe Val Leu Ala Asp Gly Arg Leu Cys Phe Ala 420 425 430			1296
20	atc ggc gac gta tcc gga aaa ggc gtg ccc gcg gcc ctg ttc atg gcc Ile Gly Asp Val Ser Gly Lys Gly Val Pro Ala Ala Leu Phe Met ala 435 440 445			1344
25	atc gtc agg acc ttg ata cgc agc gtg gcg gaa gaa gag cac gac ccg Ile Val Arg Thr Leu Ile Arg Ser Val Ala Glu Glu His Asp Pro 450 455 460			1392
30	ggc gcc atc gcc acc aag gtg aac cac cgt ctg gcc gag aac aac ccc Gly Ala Ile Ala Thr Lys Val Asn His Arg Leu Ala Glu Asn Asn Pro 465 470 475 480			1440
35	aag ctg atg ttt gtc acc ttg ctg ata ggc gtc ttc acc ccg gaa aca Lys Leu Met Phe Val Thr Leu Leu Ile Gly Val Phe Thr Pro Glu Thr 485 490 495			1488
40	ggc gcc ctg gcc tgg gtc aac gcc ggc cac ccg ccg ccg ctg ctc atc Gly Ala Leu Ala Trp Val Asn Ala Gly His Pro Pro Pro Leu Leu Ile 500 505 510			1536
45	gac gaa cgt ggc gag gtc cgc ctg ctt caa gga agc agc ggc gcg gcc Asp Glu Arg Gly Glu Val Arg Leu Leu Gln Gly Ser Ser Gly Ala Ala 515 520 525			1584
50	tgc ggc gtg ctg gac aac gag gcg tat tcc acc ctg agc acc acc ttg Cys Gly Val Leu Asp Asn Glu Ala Tyr Ser Thr Leu Ser Thr Thr Leu 530 535 540			1632
55	ccg aac ggc acc tcg ctg gtc gcg ttt acc gac ggc gtc acc gaa gcc Pro Asn Gly Thr Ser Leu Val Ala Phe Thr Asp Gly Val Thr Glu Ala 545 550 555 560			1680
60	atc cac ggc ggc tgc gcc cag tat ggt ctg ccg ccg ctg gtc gcc ctg Ile His Gly Gly Cys Ala Gln Tyr Gly Leu Pro Arg Leu Val Ala Leu 565 570 575			1728
65	atg cag ggc gcg ccg cac gca gcg gcc gaa ctc atc gag cac att ctg Met Gln Gly Ala Pro His Ala Ala Ala Glu Leu Ile Glu His Ile Leu 580 585 590			1776
70	cac gac cta cgc gaa ttc gcc gcc gat tcc gaa caa tcc gac gat ctc His Asp Leu Arg Glu Phe Ala Ala Asp Ser Glu Gln Ser Asp Asp Leu 595 600 605			1824
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610

615

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 15 Leu Ser Ala Val Val Thr Ser Val Leu Asn Ala Tyr Ala Ala Gln Ala
 35 40 45
 Glu Arg Gly His Val Thr Thr Gly Ala Ala Lys Gly Met ala Arg Val
 50 55 60
 Trp Leu Asn His Leu Asp Leu Gly Pro Arg Arg Val Ala Phe Ala Tyr
 65 70 75 80
 20 Asp Ala Glu Gly Thr Val Leu Ala Ser Thr Asn Pro Arg Met Ile Asp
 85 90 95
 Arg Asp Leu Ser Gly Ile Arg Asp Phe Lys Gly Arg Pro Leu Ala Ala
 100 105 110
 25 Ala Met Tyr Glu Glu Ser Arg Asn Asp Gly Arg Gly Phe Ala Ile Tyr
 115 120 125
 Pro Ser Pro Leu Asp Glu Ser Ala Gln Met Arg His Ala Tyr Phe Val
 130 135 140
 Tyr Phe Pro Ala Trp Lys Trp Val Leu Ala Ile Ser Asp Ser Ser Gln
 145 150 155 160
 30 Ala Ile Ile Asp Lys Val Ala Ala Gln Lys Ala Asn Met Ile Ala Ala
 165 170 175
 Ile Asp Arg Asn Leu Ser Glu Leu Arg Leu Ser Arg His Gly Phe Val
 180 185 190
 35 Phe Val Val Ala Asp Asp Gly Thr Val Ile Val Pro Pro Pro Pro Ser
 195 200 205
 Ala Ala Arg Leu Leu Asp Ser Thr Asp Val Glu Ser Gly Arg Val Leu
 210 215 220
 His Ser Met Leu Ala Glu Ile Ser Ser Thr Arg Gly Leu Thr Leu Arg
 225 230 235 240
 40 Phe Thr Asn Gly Glu Ser Ala Trp Gln Ile Asp Ala Leu Arg Tyr Lys
 245 250 255
 Pro Leu His Trp Thr Ile Ile Gly Val Val Pro Glu Pro Asp Leu Thr
 260 265 270
 45 Asp Pro Ala Gln Asn Leu Val Arg Arg Gln Ala Leu Ile Phe Ala Ala
 275 280 285
 Thr Leu Leu Ala Gly Leu Met Leu Ala Trp Val Val Ala Val Arg Ile
 290 295 300
 Ala Arg Pro Leu Ala Gln Leu Ser Asn Tyr Ala Arg Gln Leu Pro Thr
 305 310 315 320
 50 Gln Asp Leu Thr Glu Pro Ile Arg Val Pro Pro Ser Val Ala Cys Leu
 325 330 335
 Pro Arg Arg Arg Asp Glu Val Gly Gln Leu Ala Glu Ser Phe Leu
 340 345 350
 55 Phe Met Asn Glu Gln Leu His His Asn Val Arg Ala Leu Met ala Gln
 355 360 365
 Ile Ser Asn Arg Glu Arg Leu Glu Ser Glu Leu Ser Ile Ala Arg Ser
 370 375 380
 Ile Gln Leu Gly Leu Leu Pro Gln Pro Leu Pro Asp Ala Ala Thr Arg
 385 390 395 400
 60 Gly Ser Gln Leu Arg Ala Val Met Tyr Pro Ala Arg Glu Val Gly Gly

				405						410				415		
	Asp	Phe	Tyr	Asp	Tyr	Phe	Val	Leu	Ala	Asp	Gly	Arg	Leu	Cys	Phe	Ala
				420					425					430		
5	Ile	Gly	Asp	Val	Ser	Gly	Lys	Gly	Val	Pro	Ala	Ala	Leu	Phe	Met	ala
			435					440						445		
	Ile	Val	Arg	Thr	Leu	Ile	Arg	Ser	Val	Ala	Glu	Glu	Glu	His	Asp	Pro
		450					455					460				
	Gly	Ala	Ile	Ala	Thr	Lys	Val	Asn	His	Arg	Leu	Ala	Glu	Asn	Asn	Pro
	465					470					475					480
10	Lys	Leu	Met	Phe	Val	Thr	Leu	Leu	Ile	Gly	Val	Phe	Thr	Pro	Glu	Thr
					485					490						495
	Gly	Ala	Leu	Ala	Trp	Val	Asn	Ala	Gly	His	Pro	Pro	Pro	Leu	Leu	Ile
				500					505						510	
15	Asp	Glu	Arg	Gly	Glu	Val	Arg	Leu	Leu	Gln	Gly	Ser	Ser	Gly	Ala	Ala
			515					520					525			
	Cys	Gly	Val	Leu	Asp	Asn	Glu	Ala	Tyr	Ser	Thr	Leu	Ser	Thr	Thr	Leu
		530					535					540				
	Pro	Asn	Gly	Thr	Ser	Leu	Val	Ala	Phe	Thr	Asp	Gly	Val	Thr	Glu	Ala
	545					550					555					560
20	Ile	His	Gly	Gly	Cys	Ala	Gln	Tyr	Gly	Leu	Pro	Arg	Leu	Val	Ala	Leu
					565					570						575
	Met	Gln	Gly	Ala	Pro	His	Ala	Ala	Ala	Glu	Leu	Ile	Glu	His	Ile	Leu
				580					585							590
25	His	Asp	Leu	Arg	Glu	Phe	Ala	Ala	Asp	Ser	Glu	Gln	Ser	Asp	Asp	Leu
			595					600								605
	Thr	Ile	Ile	Ala	Ile	His	Arg	Pro								
							615									